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Part 3

8.—The Oxystomata and Gymnopleura (Crustacea, Brachyura) of Western Australia with Descriptions of Two New Species from Western Australia and One from India

By Marina Tyndale-Biscoe and R. W. George\*

*Manuscript received—20th March, 1962*

Among the thirty-nine species of Oxystomata in the Western Australian Museum Collection two are new species: *Ixa acuta* and *Leucosia magna*. Five species are new records for Australia, and twenty species are new records for Western Australia.

Of the five species of Gymnopleura four are new records for Australia and the fifth is new to Western Australia.

The first male pleopod is figured and described for each species. Keys and short descriptions are provided to enable all recorded species to be identified.

A new species *Leucosia biannulata* from India is also described.

#### Introduction

In 1960 the Western Australian Museum acquired a large collection of sub-littoral crustaceans. This material was dredged during a Malacological Expedition to Western Australia, which was organised and led by Mrs. M. E. King, an Associate of the Eernice P. Bishop Museum, Hawaii (George 1961, p. 24).

In this collection, the Oxystomata and Gymnopleura are particularly well represented and this prompted us to undertake a detailed study of the Western Australian species of these two groups.

We adopt Bourne's (1922) separation of the Oxystomata from the Gymnopleura. Further, in our list of references only those authors are given whose works are not mentioned by Alcock (1896), Ihle (1916 and 1918) and Barnard (1950). The diagnoses and keys only apply to the genera and species known to occur in Western Australia. Where length of carapace is given in the text, this is the greatest anterior-posterior dimension of the carapace including its projections. Catalogued specimens now housed in the Western Australian Museum collection are indicated by the abbreviation WAM preceding the catalogue number.

#### Acknowledgments

We are greatly indebted to Dr. Isabella Gordon of the British Museum (Natural History), London, who kindly examined type material and

provided valuable notes and drawings in regard to the following species—*Arcania novemspinosa*, *Leucosia reticulata*, *L. anatum*, *L. australiensis*, *L. ocellata*, *Myra affinis* and *Myra australis*.

Dr. L. B. Holthuis of the Rijksmuseum van Natuurlijke Historie, Leiden also gave invaluable assistance to us particularly in sorting out problems concerning *Leucosia anatum*, in making notes from literature unavailable to us, and in providing us with a photograph of the type of *Leucosia neocaledonica* (Milne-Edwards).

We also wish to thank Mr. Frank McNeill of The Australian Museum, Sydney; Dr. H. E. Gruner of the Zoologisches Museum, Berlin; Dr. J. H. Stock of the Zoologisch Museum, Amsterdam; Mr. G. Mack, Director of the Queensland Museum, Brisbane; Dr. G. Ramakrishna of the Zoological Survey of India, Calcutta; and Dr. John Grindley of the South African Museum, Cape Town for the loan of comparative material and for assisting us in many other ways in the completion of this work. We also gratefully acknowledge the assistance and helpful criticisms, given us by our colleagues, Drs. W. D. L. Ride and G. F. Mecs, throughout this investigation.

We wish to express our sincere thanks to the many collectors of the material dealt with in this paper, particularly to the members of the W.A.-Hawaiian Expedition and to those who made special efforts to secure crabs for us.

For the photographs in this paper we thank Mr. D. J. Burton and his staff of the West Australian Newspapers Ltd. and Mr. E. Walsh of the Zoology Department, University of Western Australia.

#### First Male Pleopods

In the study of these crabs, the shape of the various parts of the first male pleopod were found to be of diagnostic value. Few workers only have described or figured these appendages for Oxystomata or Gymnopleura: e.g. Ihle 1916, Sakai 1934, Stephensen 1945 and Barnard 1950; they only dealt with some of the species which are now known to occur in Western Australia. In this paper, the first

\* Western Australian Museum, Beaufort Street, Perth, W.A.

male pleopod for each species is described and figured. For clarity, the term "upper surface" referred to in the descriptions is that side of the pleopod which is exposed to view when the abdomen is pulled back; and the "lower surface" is the side closest to the thorax. Terms used in the descriptions are shown in Fig 1. All figures (except where otherwise stated) are camera lucida drawings of the upper surface of the left pleopods, and actual measurements of pleopod lengths are given in the legends.

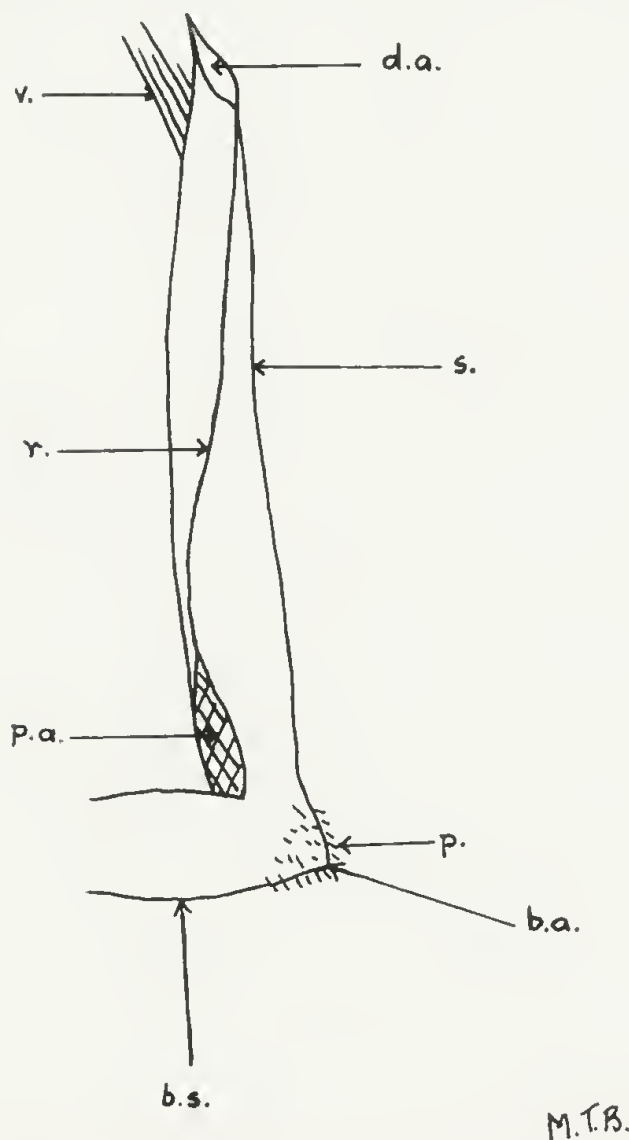


Fig. 1.—Diagrammatic representation of a first male pleopod showing parts referred to in descriptions: b.a. basal angle, b.s. basal segment, d.a. distal aperture, p. pubescence, p.a. proximal aperture, r. ridge, s. shaft, v. vibrissae.

#### Tribe OXYSTOMATA

##### Key to Families

(Adapted from Barnard 1950, p. 346)

- |   |       |               |
|---|-------|---------------|
| 1. Last two pairs of legs dorsal in position, ending in hook-like dactyls | ..... | Dorippidae    |
| Last two pairs of legs ventral and without hook-like dactyls              | ..... | 2             |
| 2. Inhalant branchial opening in front of cheliped (Fig. 8.5a.)           | ..... | Calappidae    |
| Inhalant branchial opening at bases of third maxilliped (Fig. 8.5b.)      | ..... | Leucosillidae |

#### Family DORIPPIDAE

Only one genus, *Dorippe*, is known to occur in Western Australia.

#### Genus *Dorippe* Weber

Diagnostic features. Carapace flat, sub-quadrangular and broadest behind. Last two pairs of legs, short, slender and arising dorsally, ending in hook-like dactyls. Abdomen with seven separate segments in both sexes. Second pleopod of male half to three quarters length of first pleopod.

##### Key to Species

- |  |       |                         |
|--|-------|-------------------------|
| Dorsal surface of carapace flat, almost smooth with only a few shallow grooves to indicate regions; mature animal not longer than 20 mm. | ..... | <i>D. australiensis</i> |
| Dorsal surface of carapace uneven, covered by granules and pubescence; mature animal 25 mm. or longer                                    | ..... | <i>D. frascone</i>      |

#### *Dorippe frascone* (Herbst)

*Cancer frascone* Herbst 1785, p. 192.

*Dorippe dorsipes*; Alcock 1896, p. 277 (description); Laurie 1915, p. 429; Ihle 1916, p. 112 (pleopod) and p. 148; Sakai 1937, p. 73, pl. X, fig. 4, and 1940, p. 40; Stephensen 1945, p. 63 (pleopod); Barnard 1950, p. 390 (syn. & refs.); Utinomi 1960, p. 69, pl. 35, fig. 1; Holthuis 1962, p. 54.

Non *Cancer dorsipes* Linnaeus (see Holthuis 1962, p. 54).

Diagnostic features. Carapace tubercular, rather thickly covered with pubescence. Propodus and dactyl of first three pereopods without pubescence, remaining joints of all pereopods pubescent. Colour of spirit material: yellowish beige, mottled with pink. First male pleopod about half length of abdomen.

Description of male pleopod (Fig. 2.1. WAM 334-60). Very stout at base, curved, tapering to a point. Ridge strongly curved towards outside. A line of long vibrissae along inside of tip. Some pubescence at base of shaft around proximal aperture. Basal angle blunt, pubescent.

Material examined. One male (33.2 mm) Exmouth Gulf or Shark Bay, R. McKay 6.x.1958, trawled, WAM 334-60. One male (18.8 mm), two females (22.2, 26.7 mm) Flying Foam Passage, Dampier Archipelago, W.A.-Haw. Exp. 30.v.1960, dredged, WAM 336-60. Two females (24.7, 28.9 mm) Maud Landing, W.A.-Haw. Exp. 20.v.1960, dredged at 10 fathoms on sand, weed and rock, WAM 335-60. (See locality map, Fig. 3.)

Distribution. East coast of Africa, Indo-Pacific to China, Japan, Queensland and West Australia (Barnard). Linnaeus (1758, p. 630) refers to Rumphius' (1705) descriptions of specimens from Banda and Anboina. These localities are therefore type localities.

#### *Dorippe australiensis* Miers

*Dorippe australiensis* Miers 1884, p. 258, pl. 26, fig. D; Rathbun 1924, p. 27.

Diagnostic features. Carapace flattish, sparsely, if at all, covered with minute pubescence; granules small, situated laterally. Walking legs without pubescence. Colour of spirit material: uniform pinkish-grey. First male pleopod two-thirds length of abdomen.

Description of male pleopod (Fig. 2. 2 & 3, WAM 333-60). Short, squat and bent. Tip pointed, carrying three unequal teeth; terminal tooth longest, with three small hooks. Ridge



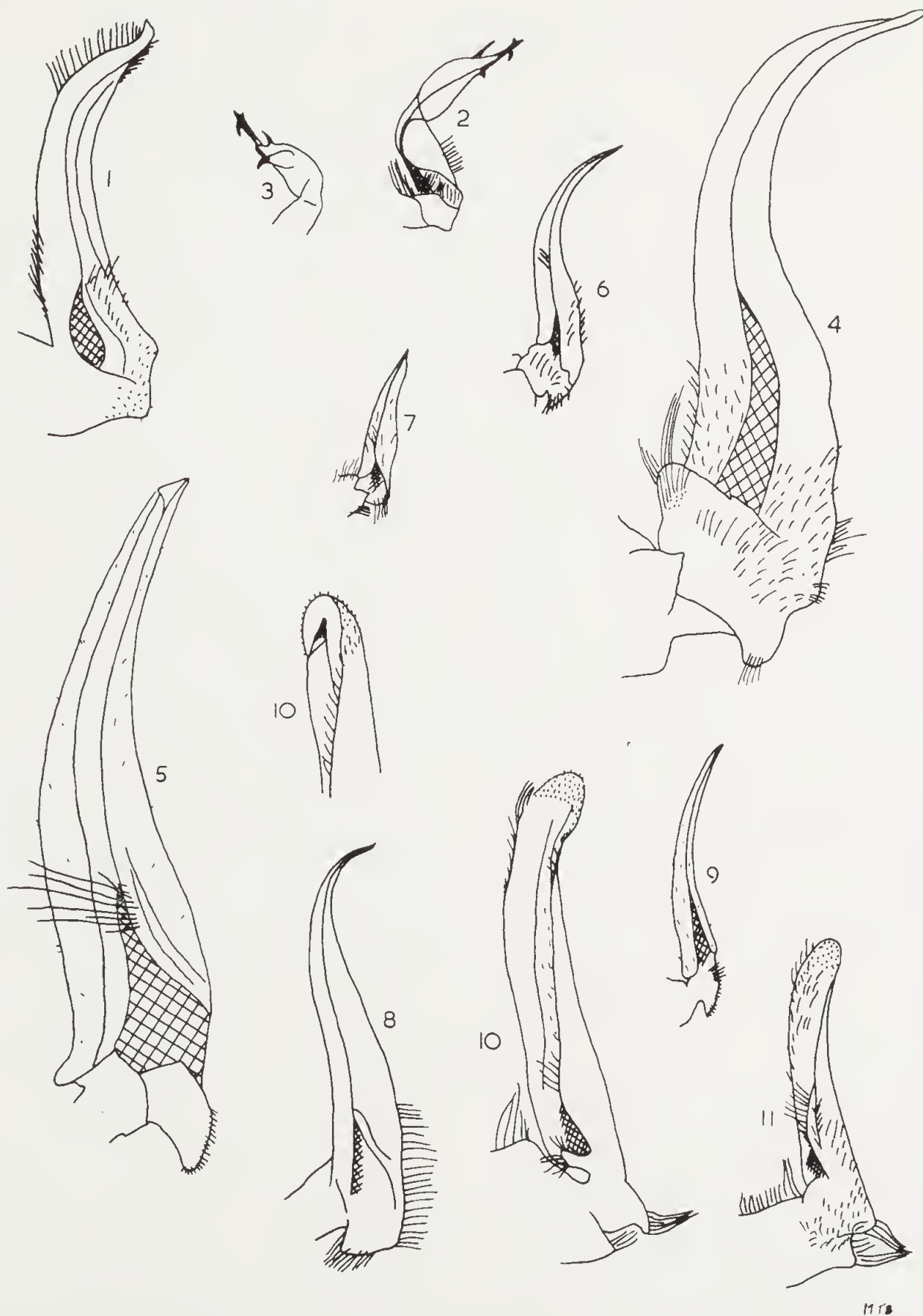


Fig. 2.—First male pleopods of Oxystomata. Actual pleopod lengths given: 1. *Dorippe frascoe* (8.9 mm); 2. *D. australiensis* (4.2 mm); 3. *D. australiensis* (lower view of tip); 4. *Calappa philargius* (5.8 mm); 5. *C. calappa* (16.3 mm); 6. *C. hepatica* (6.3 mm); 7. *C. depressa* (3.8 mm); 8. *C. lophos* (17.1 mm); 9. *C. terrae-reginae* (6.1 mm); 10a. *Matuta lunaris* (10.9 mm); 10b. *M. lunaris* (lower view of tip); 11. *M. planipes* (8.6 mm).

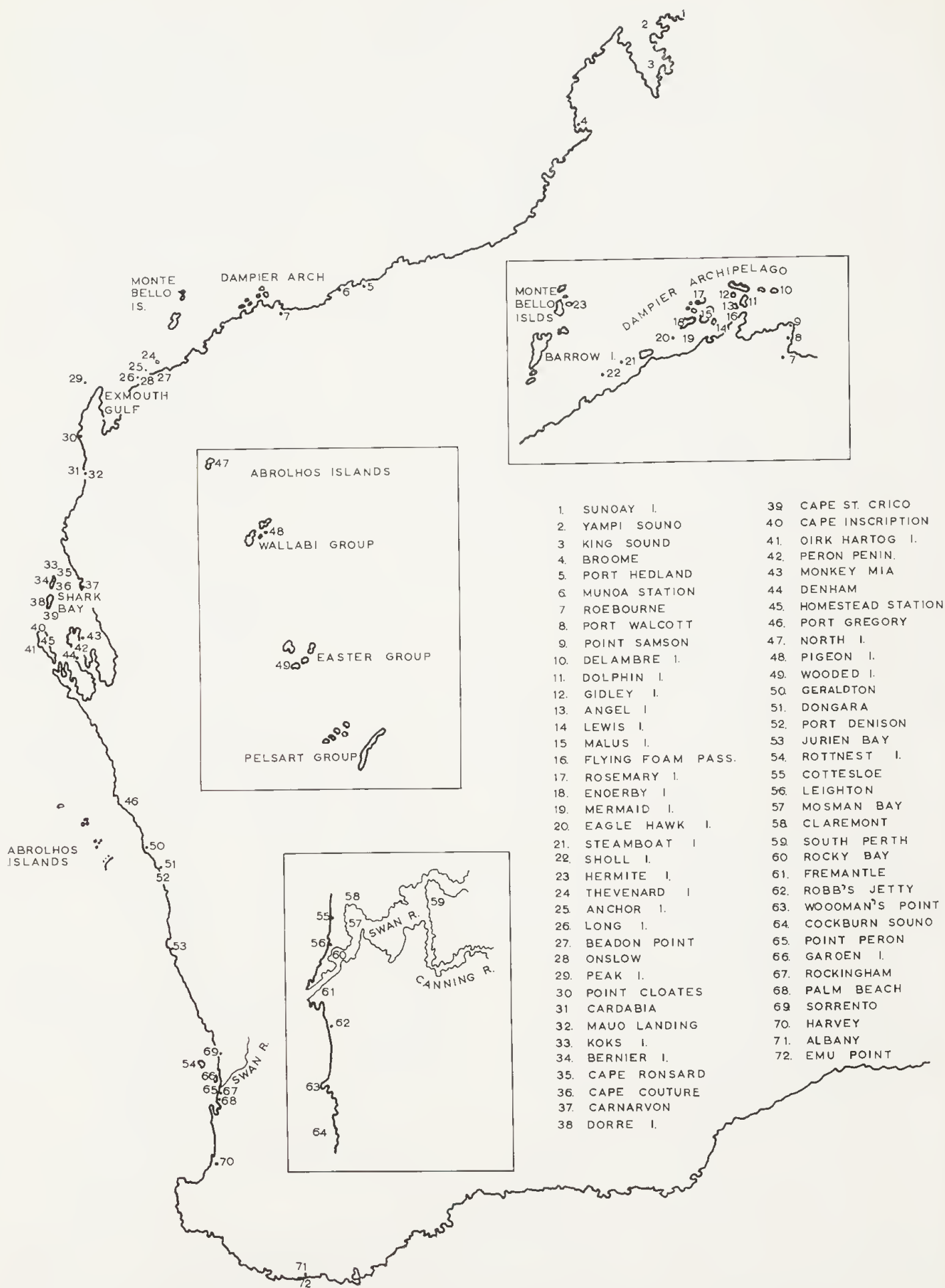


Fig. 3.—Map showing collecting localities in Western Australia (Drawn by R. Hunt).

on upper surface. Shaft with vibrissae along proximal outer margin. Proximal aperture surrounded by short pubescence. Basal angle blunt.

Material examined. One male (12.4 mm) Cockburn Sound, L. M. Marsh, August 1958, dredged at 60 feet on mud, WAM 333-60. One female (9.0 mm) Yampi Sound, G. A. Robinson, low tide under stones on reef flat, February 1959, WAM 328-60. One female (8.5 mm) Port Walcott (near Roebourne), W.A.-Haw. Exp. 3.vi.1960, dredged at 8 fathoms on sand and occasional sponge and coral, WAM 330-60. One male, Cockburn Sound, W.A. Naturalists' Club, June 1958, WAM 331-60. One female (9.0 mm) Cockburn Sound, Stn 42, W.A. Naturalists' Club, 22.vi.1958, dredged, WAM 332-60. Two males (14.0, 16.2 mm) Cockburn Sound, Stn 19, W.A. Naturalists' Club, 28.v.1958, dredged, WAM 329-60. One male (11.8 mm), Garden Island, W. B. Alexander, February 1920, WAM 9550.

Distribution. North Australia (Miers and Rathbun) and now recorded from Western Australia. The type localities are Port Denison and Moreton Bay, Queensland.

#### Family CALAPPIDAE

This family is represented in Western Australia by the genera *Calappa* and *Matuta*.

#### Key to Genera

- |   |       |                |
|---|-------|----------------|
| Third maxillipeds not completely closing the buccal cavity; distal joints of legs not flattened or expanded | ..... | <i>Calappa</i> |
| Third maxillipeds completely covering buccal cavity, distal joints of legs flattened and expanded           | ..... | <i>Matuta</i>  |

#### Genus *Calappa* Fabricius

Diagnostic features. Carapace with lateral clypeiform expansions or "wings". Third maxillipeds not meeting in mid-line, leaving mandibles exposed. Upper border of hand with denticulated crest. Formula of male abdomen  $1 + 2 + R + 6 + T$ . Abdomen of female with 7 separate segments. Second male pleopod approximately three-quarters length of first pleopod. First pleopod half to two-thirds length of abdomen.

#### Key to Species

- |  |       |                          |
|--|-------|--------------------------|
| 1. Posterior margin of carapace with 9 distinct teeth              | ..... | <i>C. philargius</i>     |
| Posterior margin not distinctly toothed                            | ..... | 2                        |
| 2. (1) Margin of clypeiform expansions smooth                      | ..... | <i>C. calappa</i>        |
| Margin of clypeiform expansions serrated or lobed                  | ..... | 3                        |
| 3. (2) Posterior half of surface of carapace ridged                | ..... | 4                        |
| Posterior half of carapace smooth                                  | ..... | 5                        |
| 4. (3) Length of carapace less than three quarters maximum breadth | ..... | <i>C. hepatica</i>       |
| Length of carapace more than three quarters maximum breadth        | ..... | <i>C. depressa</i>       |
| 5. (3) Anterior half of carapace almost smooth                     | ..... | <i>C. lophos</i>         |
| Anterior half of carapace with bulbous tubercles                   | ..... | <i>C. terrae-reginae</i> |

#### *Calappa philargius* (Linnaeus)

*Cancer philargius* Linnaeus 1758, p. 626.  
*Calappa philargius*; Alcock 1896, p. 145 (description); Rathbun 1903, p. 30 and 1924, p. 27; Laurie 1906, p. 353; Nobili 1906, p. 148; Ihle 1918, p. 183 (syn. &

refs.); McNeill & Ward 1930, p. 372; Sakai 1937, p. 92, pl. xii, fig. 3; Boone 1938, p. 210; Miyake 1939, p. 199 (*C. philargius*); Sakai 1940, p. 29; Stephensen 1945, p. 66; Holthuis 1958, p. 45; Holthuis 1959, p. 104; Utinomi 1960, p. 70, pl. 35, fig. 8.

*Calappa cristata*; Whitelegge 1889, p. 231; Stimpson 1907, p. 165.

Diagnostic features. Carapace without granulations, except on serrated postero-lateral border; posterior margin with 9 distinct teeth. Colour of spirit material: uniform pinkish-beige with paler margins; two red spots on carapace behind eyes. A red spot on hand and one on wrist of each cheliped.

Description of male pleopod (Fig. 2.4, WAM 401-38). Long, thickset at the base, curved and tapering sharply towards tip. Proximal half of pleopod covered with dense long hairs. Basal angle blunt, pubescent.

Material examined. One male (69.0 mm) Dirk Hartog I., Shark Bay, A. Ashman, March 1938, WAM 401-38. Two males (69.1, 69.6 mm), five females (19.3-76.8 mm), one juvenile (12.9 mm), Dampier Archipelago, dredged at 23 fathoms, WAM 300-60; Maud Landing WAM 298-60 & 9623; Carnarvon, trawled, WAM 302-60; 4 miles W. of Dorre I., dredged at 40 fathoms, WAM 301-60 and Swan River Estuary WAM 355-32, 479-48.

Distribution. From the Red Sea eastwards through the Indian Ocean Archipelagoes, to Japan and Samoa (Boone 1938) and East Australia (McNeill & Ward). Now recorded from Western Australia. The type locality is Asia.

#### *Calappa calappa* (Linnaeus)

*Cancer calappa* Linnaeus 1758, p. 630.

*Calappa calappa*; Ihle 1918, p. 184 (syn. & refs.); Sakai 1937, p. 90, pl. xvii, fig. 1; and 1940, p. 29; Holthuis 1959, p. 104, photo 8, figs. 2, 3; Utinomi 1960, p. 70, pl. 35, fig. 7.

*Calappa fornicata*; Alcock 1896, p. 142 (description).

Diagnostic features. Anterior portion of carapace smooth, posterior portion with transverse, wavy, beaded lines; posterior border smooth. Colour of spirit material: uniform pale yellow.

Description of male pleopod (Fig. 2.5, WAM 296-60). Long, thickset, slightly curved, tapering towards tip. Tip of proximal aperture with single tuft of long hair. Basal angle sharp with short sparse pubescence.

Material examined. One male (63.8 mm) Koks I., Shark Bay, G. Bedane 15-16.viii.1960, in fish trap, WAM 296-60. One female (68.5 mm) North I. Abrolhos Is., C. Mansom, between March and October 1960, WAM 297-60.

Distribution. Mauritius, East Africa, East Indies, Japan, New Caledonia and Hawaii (Ihle). Now recorded from Australia. Linnaeus refers to Rumphius' (1705) description of specimens from Amboina and this locality is therefore the type locality.

#### *Calappa hepatica* (Linnaeus)

*Cancer hepatica* Linnaeus 1758, p. 630.

*Calappa hepatica*; Miers 1877, p. 238; Haswell 1882, p. 136; Whitelegge 1889, p. 231; Henderson 1893, p. 395; Alcock 1896, p. 142 (description); Lenz 1905, p. 346; Grant and McCulloch, 1906, p. 24; Nobili 1906, p. 148; Jones 1909, p. 159; Rathbun 1911, p. 197; Laurie 1915, p. 247; Ihle 1918, p. 183 (syn. & refs.); McNeill 1926, p. 306; Gravely 1927, p. 142; Ward 1928, p. 243, pl. 27; Boone 1934, p. 32, figs. 8, 9 & 10; Sakai 1937, p. 89, pl. 12, fig. 2; Boone 1938, p. 212; Miyake 1939, p. 198; Buitendijk 1939, p. 230; Sakai 1940, p. 29; Stephensen 1945, p. 65 (pleopod); Barnard 1950, p. 348 (syn. & refs.); Holthuis 1958, p. 45.



Diagnostic features. Length of carapace less than three-quarters width; anterior two-thirds tuberculate and granular, posterior one-third marked with squamiform tubercles and beaded ridges. Posterior border of carapace forms a continuous curve, broken only on undersurface by three or four faint sutures. Colour of spirit material: uniform pinkish-beige, darker on anterior two-thirds, broken by some very fine red reticulations.

Description of male pleopod (Fig. 2.6 WAM 294-60). Long, curved tapering to a point. Ridge on upper surface. Proximal half of pleopod with scattered hairs. Basal angle sharp, covered with hairs.

Material examined. One male (23.5 mm) Yampi Sound, G. Robinson, February or March 1960, WAM 294-60. Two males (33.3, 40.6 mm), nine females (33.1-61.7 mm) from Sunday I., King Sound, WAM 1183-30; Yampi Sound under stones at low tide, WAM 291-60, 295-60; North West Cape 34/35-42; Point Cloates WAM 271/274-52; Port Gregory, 6 feet on broken reef, WAM 293-60 and Wallabi I., Abrolhos Is., intertidal, WAM 292-60.

Distribution. Indo-Pacific and east Australia (McNeill, Ward, Haswell). Now recorded from Western Australia. The type locality is "Indies".

#### *Calappa depressa* Miers

*Calappa depressa* Miers 1886, p. 287, pl.xxiii fig. 2; Borradaile 1903, p. 436.

Diagnostic features. Length of carapace more than three-quarters width. Other features of carapace similar to *C. hepatica*. Colour of spirit material: pale brown mottled with pink; some sharp pink markings on palm of chelipeds.

Description of male pleopod (Fig. 2.7, WAM 290-60). Pleopod almost straight, tapering to a point. Ridge on upper surface. Shaft and basal segment with a few long vibrissae. Basal angle rounded.

Material examined. One male (16.7 mm) WAM 290-60, three females (18.8-22.3 mm), one of these ovigerous, Maud Landing, W.A.-Haw. Exp. 20-21.v.1960, dredged at 7-10 fathoms, WAM 289-60, 189-60.

Distribution. Suvadiva-Atoll (Borradaile), South Australia (Miers) and now recorded from Western Australia. The type locality is South Australia.

#### *Calappa lophos* (Herbst)

*Cancer lophos* Herbst 1785, p. 201.

*Calappa lophos*; Alcock 1896, p. 144 (description); Ihle 1918, p. 182 (syn. & refs.); Balss 1935, p. 116; Sakai 1937, p. 90, pl.xii, fig. 1 & 1940, p. 40; Buitendijk 1939, p. 231; Stephensen 1945, p. 65 (pleopod); Barnard 1950, p. 351 (syn. & refs.); Utinomi 1960, p. 70, pl. 35, fig. 5.

Diagnostic features. Carapace smooth except for a few rounded elevations near front and some granules near posterior margin. Entire posterior margin beaded. Teeth on free margins of clypeiform expansions and on crest of hand, separated by deep notches. Colour of spirit material: cream with pale orange markings on posterior half of carapace and on chelipeds.

Description of male pleopod (Fig. 2.8, WAM 4-61). Stout, curved and tapering sharply to a point. Ridge on upper surface. Distal aper-

ture at tip of pleopod; proximal aperture wide. Proximal half of external surface with line of long vibrissae. Shaft with some short, scattered vibrissae (not figured). Basal angle sharp, pubescent.

Material examined. One male (85.8 mm) no data. WAM 4-61.

Distribution. Indo-Pacific from East Africa (Barnard), Persian Gulf, India (Alcock & Henderson), East Indies (Miers) and the north-west and north-east coasts of Australia (Balss, Rathbun). The type locality is "Ostindien".

#### *Calappa terrae-reginae* Ward

(Plate I.2, Plate II.2)

*Calappa terrae-reginae* Ward 1936, p. 11, pl. 3, fig. 9-11; Sakai 1937, p. 92, pl. 18, fig. 1.

Diagnostic features. Anterior half of carapace tuberculate, posterior half pitted; posterior border produced beyond level of posterior margins of clypeiform expansions. Teeth on free margins of clypeiform expansion and on crest of hand separated by shallow notches. Colour of spirit material: pale grey-pink on carapace, inside of the palm marked with orange.

Description of male pleopod (Fig. 2.9, WAM 202-60). Slender, gently curved and tapered to a point. Ridge on upper surface. Distal aperture at tip of pleopod; proximal apertures slit-like and tapered. Shaft sparsely covered with thin hairs. Basal angle sharp with a small tuft of hairs.

Material examined. One male (21.6 mm) and one female (19.6 mm), 14 miles W. of Eagle Hawk I., Dampier Archipelago, W.A.-Haw. Exp. 14.vi.1960, dredged at 10-14 fathoms, WAM 202-60, 205-60; three females (15.2-24.0 mm), Dampier Archipelago at Western Approaches to Mermaid Strait, N.E. of Malus I., and N. of Delambre I., Dampier Archipelago, W.A.-Haw. Exp., May and June 1960, dredged at 10-23 fathoms on coral and sand, WAM 203-60, 204-60 and 206-60.

Distribution. North-east Australia (Ward), Japan (Sakai) and now recorded from Western Australia. The type locality is Lindeman I., Queensland.

#### Genus *Matuta* Fabricius

Diagnostic features. Carapace flattish with a large spine or distinct tubercle on either side, at middle of lateral margin. Hand crested with two raised stridulating areas on inner surface of upper margin. Walking legs with last two joints flattened to form swimming paddles. Abdominal formula of male 1 + 2 + R + 6 + T; abdomen of female with 7 separate segments. Second pleopod of male longer than first. First pleopod half to three quarters length of abdomen.

#### Key to Species

- |        |  |                     |
|--------|--|---------------------|
| 1.     | Middle of each lateral margin with large spine | 2                   |
|        | Middle of each lateral margin with tubercle    | <i>M. inermis</i>   |
| 2. (1) | Fifth joint of fourth leg bicarinate           | 3                   |
|        | Fifth joint of fourth leg with single keel     | 4                   |
| 3. (2) | Rostrum distinctly bilobed                     | <i>M. granulosa</i> |
|        | Rostrum slightly, if at all, bilobed           | <i>M. banksi</i>    |
| 4. (2) | Outer surface of hand with two distinct spines | <i>M. lunaris</i>   |
|        | Outer surface of hand with one distinct spine  | <i>M. planipes</i>  |



### *Matuta lunaris* (Forsk.)

*Cancer lunaris* Forsk. 1775, p. 91.

*Matuta lunaris*; Rathbun 1903, p. 30 and 1908-1910, p. 305; Ihle 1918, p. 185 (syn. & refs.); Chopra 1933, p. 31; Sakai 1937, p. 100, pl. xiii, fig. 3 and 1940, p. 29; Buitendijk 1939, p. 231; Barnard 1950, p. 358 (syn. & refs.); Holthuis 1959, p. 104; Utinomi 1960, p. 69, pl. 35, fig. 3.

*Matuta victrix*; Walker 1887, p. 111; Lanchester 1900, p. 762.

*Matuta victor*; Alcock 1896, p. 160 (description); Lenz 1905, p. 347; Nobili 1906, p. 149; Stimpson 1907, p. 166; Graveley 1927, p. 142.

**Diagnostic features.** Two distinct spines on outer surface of hand. Rostrum bilobed. Colour of spirit material: carapace and chelipeds covered with minute red spots.

**Description of male pleopod** (Fig. 2.10a, & b, WAM 315-60). Thickset, with expanded spoon-shaped flap at tip. Flap opens on lower side and covers a single tooth. Distal aperture opens at tip of tooth. Ridge on upper surface of pleopod, oblique, fringed in part with vibrissae. Flap covered with short pubescence. Basal angle sharp with tuft of long hairs.

**Material examined.** One male (40.2 mm), Yampi Sound, G. A. Robinson, August or September 1959, WAM 315-60. Seventeen males (22.4-41.6 mm), ten females (26.9-36.9 mm), one of these ovigerous between October and December, from Yampi Sound, WAM 2-61, 308/311-60, 312/314-60 & 317-60; Maud Landing, WAM 307-60; Point Cloates WAM 275-52; 80 miles north of Carnarvon WAM 217-47 and Shark Bay on sandy beach WAM 316-60. (One male, Yampi Sound, G. A. Robinson, December 1960, WAM 2-61, donated to Leiden Museum).

**Distribution.** Indian Ocean (Barnard, Alcock), East Indies and Asia (Stimpson, Ihle, Sakai) and east Australia (Haswell). Now recorded from Western Australia. The type locality is Red Sea.

### *Matuta planipes* Fabricius

*Matuta planipes* Fabricius 1798, p. 3669; Ihle 1918, p. 308 (syn. & refs.); Rathbun 1923, p. 138; Balss 1935, p. 116; Sakai 1937, p. 101, pl. xiii, fig. 4 and 1940, p. 40; Buitendijk 1939, p. 232; Stephensen 1945, p. 67 (pleopod); Barnard 1950, p. 357; Utinomi 1960, p. 69, pl. 35, fig. 4.

*Matuta lunaris*; Alcock 1896, p. 161 (description); Lanchester 1900, p. 763; Stimpson 1907, p. 166.

**Diagnostic features.** One distinct spine on outer surface of hand. Rostrum bilobed. Colour of spirit specimens: carapace and dactyl of last walking leg covered with red reticulations.

**Description of male pleopod** (Fig. 2.11 WAM 324-60). Thickset, with non-expanded rounded flap. Ridge oblique with long vibrissae proximally. Inner distal and outer proximal regions of shaft pubescent. Basal angle blunt with tuft of long hairs.

**Material examined.** One male (29.8 mm) between East and West Lewis Is., Dampier Archipelago, W.A.-Haw. Exp. 12.vi.1960, dredged, WAM 324-60. One male (37.3 mm), Yampi Sound, G. A. Robinson, March 1959, under stones in low tide pools, WAM 325-60. One female (29.1 mm), Broome, Jennifer Johnson, 26.viii.1961, on flats at low tide, WAM 115-61. One female (32.7 mm), Port Hedland, V.

Glauert, December 1950, WAM 273-50. One juvenile (15.5 mm) Mundabullangana, A. M. Douglas and G. F. Mees, 29.v.1960, WAM 327-60. One male (26.0 mm), Dolphin I., Dampier Archipelago, W.A.-Haw. Exp. 29.v.1960, sand bar at night, WAM 323-60. Four males (21.0-36.4 mm) between East and West Lewis Is., Dampier Archipelago, W.A.-Haw. Exp. 12.vi.1960, dredged, WAM 326-60.

**Distribution.** North and north-west Australia (Balss and Miers) and Indian Ocean, East Asia and Japan (Sakai). The type locality is "Oceano Indico".

### *Matuta banksi* Leach

*Matuta banksi* Leach 1817, p. 14; Alcock 1896, p. 158 (description); Lanchester 1900, p. 762; Nobili 1906, p. 149; Ihle 1918, p. 185 (syn. & refs.); Balss 1935, p. 116; Sakai 1937, p. 98, pl. xiii, fig. 2; Buitendijk 1939, p. 231; Barnard 1950, p. 359.

**Diagnostic features.** One large and one small spine on outer surface of hand. A distinct tubercle in middle of postero-lateral margin. Surface of carapace with six prominent granules. Rostrum simple. Colour of spirit material: pale yellowish beige, with minute red spots on surface of carapace and chelipeds.

**Description of male pleopod** (Fig. 4.1 WAM 303-60). Thickset with expanded terminal flap. Ridge oblique without vibrissae. Whole of pleopod densely covered with long pubescence. Basal angle very blunt, rounded with long hairs.

**Material examined.** One male (32.3 mm) between East and West Lewis Is., Dampier Archipelago, W.A.-Haw. Exp. 12.vi.1960, dredged, WAM 303-60. Four males (28.4-49.9 mm); four females (29.5-38.2 mm), one of these (30.0 mm) ovigerous collected in July, from Dampier Archipelago at Dolphin I., on sand spit, WAM 304-60; Monte Bello Is., in Mangrove creek WAM 305-60 and Maud Landing near beach, WAM 306-60.

**Distribution.** Indo Pacific (Ihle 1918), east Australia (Haswell), north west Australia (Balss). The type locality is not given by Leach.

### *Matuta granulosa* Miers

*Matuta granulosa* Miers 1877, p. 245, pl. xxxix, fig. 8 and 9; de Man 1881, p. 114; Haswell 1882, p. 134; Ortmann 1892, p. 572; Nobili 1899, p. 251; Ihle 1918, p. 308.

**Diagnostic features.** A line of distinct spines and three granules on outer surface of hand. Colour of spirit material: carapace, legs and chelipeds covered with red spots; base of lateral spines red.

**Description of male pleopod** (Fig. 4.2, WAM 321-60). Thickset with slightly expanded terminal flap. Ridge oblique, sinuous, fringed with long vibrissae proximally and hairs distally. Inner distal and outer proximal regions of shaft pubescent. Basal angle blunt with short and long hairs.

**Material examined.** One male (48.1 mm) Yampi Sound, G. A. Robinson, May 1959, WAM 321-60. One male (24.2 mm) Dolphin I., Dampier Archipelago, W.A.-Haw. Exp. 29.v.1960, on sand bar at night, WAM 320-60. One male (26.7 mm) Sholl I., W.A.-Haw. Exp. 14.vi.1960, dredged, WAM 319-60. Two females (48.8, 51.4 mm), both ovigerous, one juvenile (15.0 mm) 4



miles S.W. of Cape Ronsard, Bernier I., W.A.-Haw. Exp. 16.v.1960, dredged at 30 fathoms, WAM 318-60. One male (24.9 mm), one female (44.0 mm) no data.

Distribution. Queensland (Haswell) and the Indian Ocean (Nobili). Now recorded from Western Australia. The type locality is Eastern Seas.

#### *Matuta inermis* Miers

*Matuta inermis* Miers 1884, p. 256, pl. xxvi, fig. C and 1886, p. 296; Alcock 1896, p. 157; Rathbun 1924, p. 27.

Diagnostic features. Carapace longer than broad, anterior two thirds covered with coarse granules, lateral margin with small tubercle. Crest of hands with 3 sharp spines. Colour of fresh material: pinkish beige, darker pink on anterior half of carapace; red reticulations on carapace and chelipeds.

Material examined. One ovigerous female (20.1 mm) and one juvenile male (17.8 mm) 1 m. south of Delambre I., Dampier Archipelago, B. R. Wilson and G. W. Kendrick, 30.viii.1961, dredged at 6 fathoms, WAM 119-61.

Distribution. Northern Australia (Miers); Cape Jaubert, near Broome (Rathbun). The type localities are Albany I., Thursday I., Prince of Wales Channel, and Torres Straits.

#### Family LEUCOSIIDAE

##### Key to Genera

- |        |  |                                  |
|--------|--|----------------------------------|
| 1.     | Lateral margin of carapace with one large spine or projection ...  | <i>Ixa</i>                       |
|        | Lateral margin of carapace with more than one distinct spine, tubercle or angular projection               | 2                                |
|        | Lateral margin of carapace smooth or with line of small granules   | 5                                |
| 2. (1) | Anterior margin of carapace quadridentate  | 3                                |
|        | Anterior margin of carapace bidentate  | 4                                |
| 3. (2) | Regions of carapace clearly defined  | <i>Ebalia</i> ( <i>Phlyxia</i> ) |
|        | Regions of carapace not defined  | <i>Philyra</i>                   |
| 4. (2) | Carapace without spines, liberally pitted  | <i>Actaeomorpha</i> *            |
|        | Carapace covered with coarse or fine spines  | <i>Arcania</i>                   |
| 5. (1) | No projections on posterior margin of carapace   | 6                                |
|        | Three projections on posterior margin of carapace  | 8                                |
| 6. (5) | Anterior portion of carapace snout-like; front anterior to epistome and straight or projecting beyond eyes | 7                                |
|        | Anterior portion of carapace not snout-like; front posterior to epistome and not projecting beyond eyes    | <i>Philyra</i>                   |
| 7. (6) | Thoracic sinus present   | <i>Leucosia</i>                  |
|        | Thoracic sinus not present   | <i>Pseudophilyra</i>             |
| 8. (5) | All three posterior projections of carapace in one horizontal plane  | <i>Randallia</i>                 |
|        | Middle posterior projection of carapace above level of lateral ones  | 9                                |
| 9. (8) | Distal ends of fingers extremely curved and cross over some distance behind tips                           | <i>Myrodes</i>                   |
|        | Distal ends of fingers slightly curved and just overlap at tip   | <i>Myra</i>                      |

\* No representatives of this genus have been seen by the authors, see pp. 75-76.

#### Genus *Ixa* Leach

Diagnostic features. Carapace broadly rhomboidal, with lateral margin produced to form one large spine. Chelipeds and legs very slender; distal half of hand filiform. Abdominal formula of male 1 + 2 + R + 6 + T. Second male pleopod one-fifth length of first pleopod.

Only one species of *Ixa* is known from Western Australia.

#### *Ixa acuta*, sp. nov.

(Plate I.1, Plate II.1)

Description of Holotype. Front of carapace divided into two distinct pointed lobes. Centre of hepatic regions with small rounded prominence, hepato-branchial angle very sharp. Two longitudinal grooves on posterior half of carapace shallow, naked and faintly bifurcate anteriorly.

Submedian tubercles petaloid, very prominent and set close together. Intestinal protuberance also very prominent. Posterior portion of branchial region with very distinct rounded protuberance; from which a small ridge of granules leads forward on dorsal surface toward midline.

Width at base of lateral spine one-third length of spine. Lateral spine constricted near base, tapered gradually to a very sharp point. Surface of carapace covered unevenly with large rounded pearly tubercles, most numerous on base of lateral spine and on posterior region of carapace. Surface of abdomen and sternum of thorax with largest tubercles. Surface of carapace minutely granulated between tubercles. Whole of anterior surface of carapace and surface of third maxillipeds with minute granulations. Convex distal portion of exopodite of third maxilliped with some small sharp tubercles. Length of cheliped a little less than distance between tips of lateral spines. Merus cylindrical, coarsely granulate on proximal half with granulations progressively finer distally. Cheliped little stouter than walking legs; markedly less than twice length of carapace. Distal half of hand almost filiform; fingers filiform, open in a vertical plane and hardly half length of hand.

Male abdominal formula 1 + 2 + R + 6 + T. First segment thin and narrow. Second segment with convergent sides and a pair of proximal lateral elevations. Segments R, 6 and T gradually narrowing to pointed tip of abdomen, lateral margins straight except for slight sinuation on fused segment, R.

Description of male pleopod (Fig. 4.3, WAM 201-60). Long and slender, tapered towards tip. Basal half with slight S-shaped curve, distal half almost straight. Proximal aperture fairly wide with short pubescence on both lips. Ridge on upper surface. Distal aperture terminal; without spinules at tip. Some long vibrissae on ridge at level of tip of proximal aperture. Rest of pleopod covered with sparse, evenly distributed vibrissae. Basal angle round.

Holotype male. (17.8 mm) K. Godfrey on R.V. "Lancelin" 24.ii.1956. Trawled. WAM 201-60.

Type locality. West side of Exmouth Gulf, Western Australia.

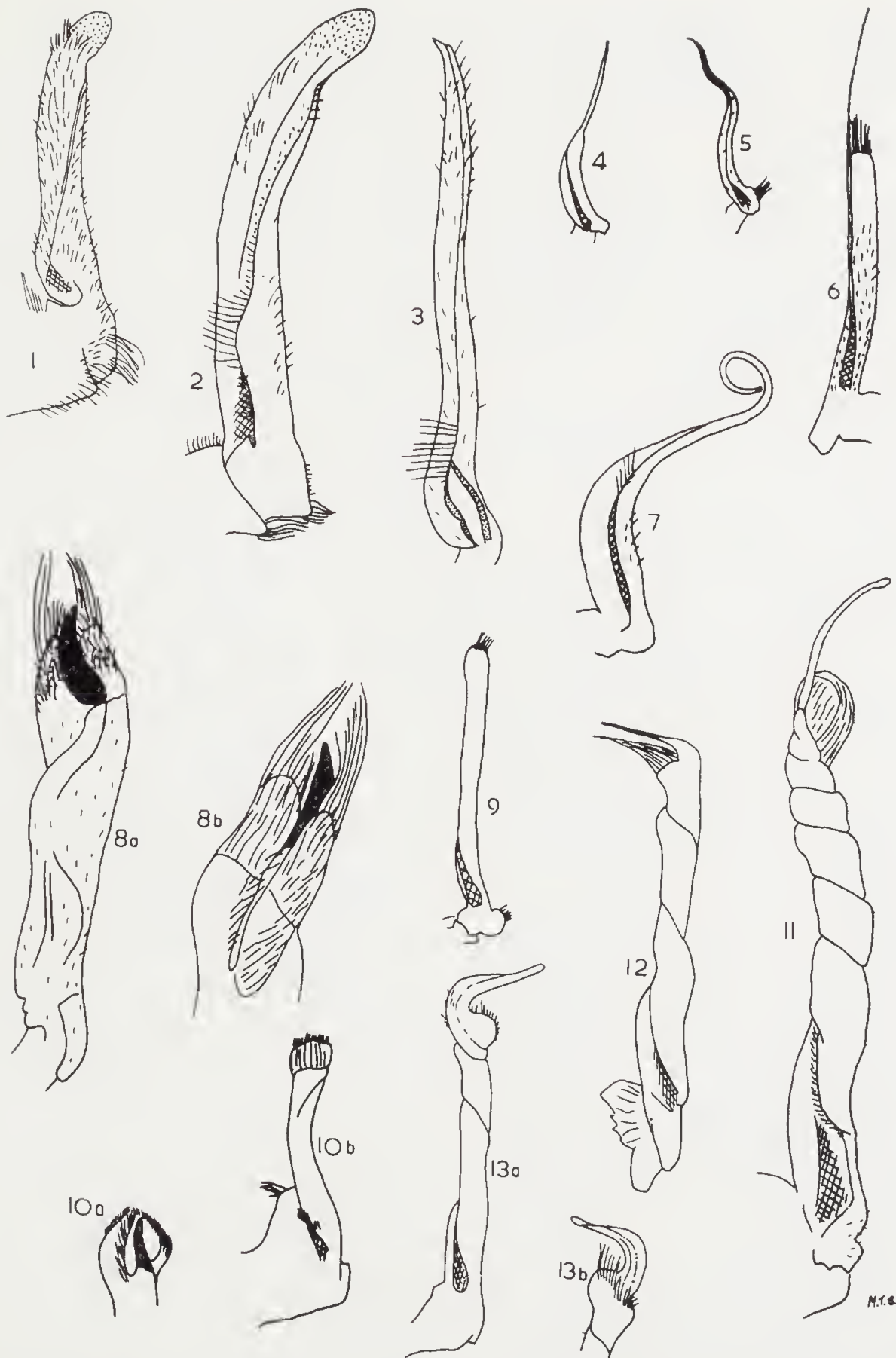


Fig. 4.—First male pleopods of Oxystomata. Actual pleopod lengths given: 1. *Matuta banksi* (10.1 mm); 2. *M. granulosa* (14.3 mm); 3. *Ixa acuta* (Holotype) (11.5 mm); 4. *Ebalia* (*P.*) *intermedia* (4.4 mm); 5. *E. (P.) dentifrons* (4.4 mm); 6. *Philyra scabriuscula* (6.2 mm, right pleopod); 7. *P. laevis* (9.5 mm); 8a. *P. orbicularis* (12.5 mm); 8b. *P. orbicularis* (lower view of tip); 9. *P. platychira* (6.9 mm); 10a. *Leucosia whitei* (7.4 mm); 10b. *L. whitei* (lower view of tip, some hair removed); 11. *L. reticulata* (17.3 mm); 12. *L. anatum* (11.7 mm); 13a. *L. biannulata* (Holotype) (11.5 mm); 13b. *L. biannulata* (Holotype) (lower view of tip).



Comments. *Ixa acuta* resembles *I. edwardsi* Lucas and *I. monodi* Holthuis & Gottlieb, in lacking the deep grooves on the carapace exhibited by *I. cylindrus* (Fabricius) and *I. inermis* Leach. The points of difference between *I. acuta*, *I. edwardsi* and *I. monodi* are given in Table I, p. 94.

**Genus Ebalia Leach**  
**Subgenus Phlyxia Miers**

Diagnostic features. Carapace rounded, with quadridentate front. Regions of carapace fairly well defined; lateral margin with several projecting tubercles. Abdominal formula of male 1 + 2 + R + T. Second male pleopod as long or a little longer than first pleopod. First pleopod three-quarters length of abdomen.

**Key to Species**

Carapace covered with numerous obvious rugosities .. ..	<i>E. (P.) dentifrons</i>
Carapace covered with microscopic granules .. ..	<i>E. (P.) intermedia</i>

**Ebalia (Phlyxia) intermedia Miers**

*Ebalia (Phlyxia) intermedia* Miers 1886, p. 308, pl. 25, fig. 2 (description); Ihle 1918, p. 310, Balss 1935, p. 117. *Phlyxia intermedia*; Rathbun 1923, p. 135; Hale 1927, p. 198, fig. 199.

Diagnostic features. Carapace covered with microscopic granules; intestinal region with sharp median spine. Cheliped of male more than one and a half times length of carapace. Colour of fresh material: "olivaceous, grey or almost white, often with darker mottlings" (Hale 1927, p. 199). Abdominal formula of female 1 + 2 + R + T.

Description of male pleopod (Fig. 4.4, WAM 258-60). Small and slender, proximal half bent in a wide arc; distal half much narrower than proximal half and slightly sinuous. Distal aperture at tip of pleopod; proximal aperture slit-like and extended to almost half length of pleopod. No obvious pubescence. Basal angle round and flat.

Material examined. One male (9.3 mm) Woodmans Point, Cockburn Sound, B. R. Wilson, 16.viii.1958, WAM 258-60. Eleven males (7.7-11.3 mm); five females (7.3-10.3 mm); three of these (8.4, 8.8 and 9.4 mm) ovigerous, February and May, from 2 miles W.N.W. of Cottesloe, dredged at 4 fathoms, WAM 254-60; Cockburn Sound under dead *Posidonia*, WAM 255/7-60 and 288/52 and Garden I., WAM 9547.

Distribution. Southern coast of Australia (Balss), South Australia, Victoria and Tasmania (Hale, Rathbun and Miers). The type locality is off the entrance to Port Phillip, Victoria.

**Ebalia (Phlyxia) dentifrons Miers**

*Ebalia (Phlyxia) dentifrons* Miers 1886, p. 310, pl. 25, fig. 4 (description); Ihle 1918, p. 310. *Phlyxia dentifrons*; Hale 1927, p. 200, fig. 201.

Diagnostic features. Surface of carapace with numerous large rugosities; hepatic margin very swollen. Cheliped of male less than one and a half times length of carapace. Colour of spirit material: uniform pale brown with orange dactyls of walking legs. Abdominal formula of female 1 + R + T.

Description of male pleopod (Fig. 4.5, WAM 259-60). Small and slender, sinuate and gradually tapering to a sharp point. Distal aperture at tip. Proximal aperture short. A few vibrissae on shaft. Basal angle blunt with tuft of hairs.

Material examined. One male (8.6 mm) Point Peron, W. H. Butler, June 1959, WAM 259-60. One male (7.2 mm), three females (7.6-8.0 mm) all ovigerous, Dongara, B. R. Wilson, 24.viii.1958, WAM 264-60. One male (8.9 mm) 2 miles W.N.W. of Cottesloe, W.A.-Haw. Exp. 4.v.1960 dredged at 9 fathoms, WAM 260-60. One female (11.0 mm) ovigerous, Cottesloe Beach, L. Glauert, 1936, WAM 261-60. One female (10.6 mm) Point Peron, W. H. Butler, 11.iv.59, WAM 262-60.

Distribution. South Australia, Victoria and New South Wales (Hale, Miers). Now recorded from Western Australia. The type locality is South Australia.

**Genus Philyra Leach**

Diagnostic features. Carapace circular; epistome projecting beyond front; margin bounded by a continuous beaded line originating just behind front (except in *P. laevis*). Cheliped more massive than ambulatory legs. Abdominal formula of male and female 1 + R + T or 1 + 2 + R + T; fusion lines sometimes quite distinct. Second pleopod about one-fifth to one-third length of first pleopod. First pleopod three-quarters to nearly equal length of abdomen.

**Key to Species\***

- |   |                        |   |
|---|------------------------|---|
| 1. Lateral borders with three angular projections .. ..           | <i>P. laevis</i>       | - |
| Lateral border with an even line of granules .. ..                | 2                      |   |
| 2. (1) Cutting edge of immovable finger with fringe of hair .. .. | <i>P. platychira</i>   |   |
| Cutting edge of immovable finger without fringe of hair .. ..     | 3                      |   |
| 3. (2) Surface of carapace with some distinct granulations .. ..  | <i>P. scabriuscula</i> |   |
| Surface of carapace smooth .. ..                                  | <i>P. orbicularis</i>  |   |

**Philyra scabriuscula (Fabricius)**

*Leucosia scabriuscula* Fabricius 1798, p. 349. *Philyra scabriuscula*; Alcock 1896, p. 239 (description); Lenz 1905, p. 347; Ihle 1918, p. 315; Stephensen 1945, p. 88 (Pleopod); Barnard 1950, p. 381, fig. 72, i.

Diagnostic features. Surface of carapace, except anterior quarter, closely covered with low rounded granulations. Opposing edges of fingers of chelipeds serrated. Colour of spirit material: uniform dark slate-grey, with brown chelipeds, and pale grey ventral surface. Male and female abdominal formula 1 + 2 + R + T.

Description of male pleopod (Fig. 4.6, WAM 15-52). Stout and parallel sided. Tip rounded with fringe of long hairs. Ridge on outer edge, continued as a long thin projecting fibre. Surface of shaft especially proximal half, covered with long pubescence. Basal angle long and blunt.

Material examined. One male (15.0 mm), Sorrento Beach, W. H. Butler, January 1952, WAM 15-52. One female (12.4 mm) Beadon

\* This key does not include *Philyra angularis* Rathbun, as the species is not represented in the Western Australian Museum collection. See p. 75.



Bay, Onslow, K. Godfrey on R.V. "Lancelin", 17.xi.1955, off beach, WAM 269-60. Two males (14.2, 15.1 mm), six females (11.4-14.0 mm) two of these (12.4, 12.7 mm) ovigerous, rest parasitised, Sorrento Beach, W. H. Butler, January 1952, collected in shallow water, WAM 16/24-52. One female (14.0 mm), ovigerous, South Fremantle, February 1927, WAM 13323. Two males (14.1, 14.2 mm), beach W. of Harvey, M. Snell, December 1935, WAM 211/212-35. One male (12.2 mm), parasitised, four females (12.6-13.4 mm) all ovigerous, beach W. of Harvey, M. Snell, January 1936, WAM 19/23-36.

Distribution. Indian Ocean from East Africa (Barnard, Lenz), through India to the Malayan Seas (Alcock, Henderson). Now recorded from Australia. The type locality is "India orientali".

#### *Philyra laevis* Bell

*Philyra laevis* Bell 1855a, p. 300, pl. 32, fig. 7; Haswell 1879, p. 53 and 1882, p. 124; Ortmann 1892, p. 583; Ihle 1918, p. 315; Hale 1927, p. 194.

Diagnostic features. Carapace sub-circular, with three slightly angular projections on either side; surface smooth. Colour of spirit material: dark slate-grey with four small white spots on dorsal surface; four smaller dots in transverse line anterior to spots. Two posterior angulations and intestinal region often white to creamy. Underside of body, legs and chelipeds also white to creamy. Abdominal formula of male 1 + 2 + R + T, of female 1 + R + T.

Description of male pleopod (Fig. 4.7, WAM 267-60). Medium thickness at base, curved, tapered towards tip. Distal third sometimes slightly bent (making the whole pleopod S-shaped) or looped. Proximal aperture long and slit-like with few vibrissae at tip. Basal angle blunt.

Material examined. One male (20.5 mm), Emu Point, Albany, B. R. Wilson, low tide on sandy flats, 7.i.1959, WAM 267-60. Two males (15.4, 17.3 mm); one female (16.4 mm) Peaceful Bay, Albany, A. Kalnins, between December and February 1957, WAM 266-60. Two males (16.1, 17.2 mm), one female (20.2 mm), ovigerous, Emu Point, Albany, B. R. Wilson, 7.i.1959, sand flats, WAM 268-60. One female (15.9 mm) Nannarup Beach, Albany, J. Hamer, April 1934, WAM 69-34.

Distribution. Southern Australia; from south-west of Australia, Victoria and Tasmania (Hale and Haswell). The type locality is Port Adelaide, South Australia.

#### *Philyra orbicularis* (Bell)

*Leucosia orbicularis* Bell 1855a, p. 284, pl. 30, fig. 1; Haswell 1879-80, p. 44 and 1882, p. 118.

*Pseudophilyra orbicularis*; de Man 1888, p. 199; Ihle 1918, p. 314.

*Philyra orbicularis*; Henderson 1893, p. 398.

Diagnostic features. Surface of carapace smooth. Cutting edge of immovable finger without fringe of hairs. Sides of abdomen parallel for proximal two-thirds, converging only at distal ends. Colour of spirit material: carapace light grey, joints of fore legs and base of fingers banded orange. Abdominal formula of male 1 + R + T; of female 1 + 2 + R + T.

Description of male pleopod (Fig. 4.8a & 8b, WAM 11738). Medium length, stout and almost straight. Proximal aperture on inner side,

about one-third length of pleopod. Ridge sinuous on inner side of pleopod ending in a solid tooth with distal aperture at tip; tooth surrounded by two membranous projections with tufts of long vibrissae. Soft pubescence on shaft of pleopod. Basal angle rounded, small and blunt.

Material examined. One male (21.2 mm) Cottesloe, L. Glauert, 26.vii.1926, WAM 11738. One juvenile (10.0 mm) Port Hedland, Mr. Brown, October 1961, WAM 122-61. One female (20.3 mm) four miles north of Thompsons Bay, Rottnest I., W.A.-Haw. Exp. 7.v.1960, dredged in 19 fathoms on sand, WAM 265-60. One female (21.0 mm), one juvenile (15.6 mm) Cottesloe, L. Glauert, 26.vii.1926, WAM 11736/7.

Comments Ihle (1918 p. 314), following de Man (1888, p. 199), refers this species to the genus *Pseudophilyra*. De Man, however, gave no reason for doing so. We agree with Henderson (1893, p. 398) that it does not belong to either the genus *Leucosia* or *Pseudophilyra* but to the genus *Philyra* Leach 1817 because:

- (1) there is no thoracic sinus;
- (2) the anterior margin of the carapace is not snout-like;
- (3) the epistome projects beyond the front.

Distribution. Coasts of Australia (Haswell, Bell). These are the first definite records from Western Australia. The type locality is "Coasts of Australia".

#### *Philyra platychira* de Haan

*Philyra platychira* de Haan 1841, p. 132; Alcock 1896, p. 242 (description); Ihle 1918, p. 315; Barnard 1950, p. 382 (syn. & refs.); Buitendijk 1939, p. 229.

*Philyra platychira*; Sakai 1937, p. 156, pl. xv, fig. 6 and 1940, p. 40.

Diagnostic features. A tuft of hairs on cutting edge of immovable finger. Colour of spirit material: uniform beige brown with tips of chelipeds lighter in colour. Abdominal formula of male 1 + R + T, of female 1 + 2 + R + T.

Description of male pleopod (Fig. 4.9, WAM 337-60). Long and straight, of medium thickness; tip round with a small spine and a few vibrissae. Ridge oblique on lower surface of pleopod. Shaft without pubescence. Basal angle prominent, rounded with few vibrissae.

Material examined. One male (13.8 mm) Jervois Groyne, Cockburn Sound, E. J. Car, January 1956, at 1 fathom in sand, WAM 337-60. Two males (11.9, 13.7 mm), five females (10.3-12.0 mm) from five localities in Cockburn Sound, near Fremantle, WAM 338/341-60.

Distribution. Indo-Pacific from East Africa (Barnard), Persian Gulf, Indian Archipelago (Alcock, Laurie and Henderson), Hong Kong (Stimpson), Japan (de Haan), Timor (Buitendijk) to east Australia (McNeill and Ward). Now recorded from Western Australia. The type locality is Japan.

#### *Philyra angularis* Rathbun

This species is not represented in the Museum collection. The type, an adult female, was recorded from Cape Jaubert, near Broome.

#### Genus *Actaeomorpha* Miers

Two species of this genus have been recorded from Western Australia:



### *Actaeomorpha sculpta* (Haswell) variety?

One immature female, Cape Jaubert, near Broome at 70 or 80 feet (Rathbun 1924, p. 25, pl. 1, fig. 12).

### *Actaeomorpha erosa* Miers

One immature male, Surf Point, Shark Bay, at  $\frac{1}{2}$ - $3\frac{1}{2}$  metres (Balss 1935, p. 117).

We have seen no Western Australian specimens of these two species of *Actaeomorpha*.

### Genus *Arcania* Leach

Diagnostic features. Carapace globular, ovoid or rhomboidal, lateral and posterior margins armed with spines or tubercles. Front bilobed and prominent. Chelipeds very slender and about twice length of carapace.

#### Key to Species

1. Dorsal surface of carapace covered with tiny evenly distributed sharp spines ..... *A. novem-spinosa*  
Dorsal surface of carapace densely covered with large composite spines ..... *A. tuberculata*

### *Arcania tuberculata* Bell

*Arcania tuberculata* Bell 1855a, p. 310, pl. 34, fig. 8; Alcock 1896, p. 268 (description); Laurie 1906, p. 366.  
*Arcania laevimana* Bell 1855a, p. 310, pl. 34, fig. 10; Ihle 1918, p. 264.

Diagnostic features. Carapace globular, covered with composite spines; and with small dumbbell-shaped spines between these. Cheliped about as long as carapace. Colour of spirit material: uniformly yellow beige. Abdominal formula of female  $1 + 2 + R + T$ .

Material examined. One female (12.9 mm) Cottesloe 1931, L. Glauert, WAM 282-60.

Comments. Bell (1855a) stated that his *A. laevimana* (a female) had simple spines on the carapace and an acute angle between the rostral horns, whereas his *A. tuberculata* (a male) had tuberculate spines and a wide angle between the rostral horns. Our female has heavily tuberculated spines on the carapace and a wide angle between the horns, thus agreeing with his *A. tuberculata* description.

Ihle (1918) found that each of his specimens (2 males and 3 specimens of unknown sex) had a wide angle between the rostral horns and although the spines on the carapace appeared simple when examined with the naked eye, under the lens he saw tiny secondary spines, much smaller than those figured by Bell for *A. tuberculata*. Ihle suggested that *A. tuberculata* and *A. laevimana* might be synonymous and noted that if this is true, *A. tuberculata* has priority.

From these descriptions it appears that the nature of the carapace spines varies from smooth, through microscopically spinulate, to heavily tuberculate and these variations appear to be independent of the sex of the specimen. We support Ihle by accepting these differences as natural morphological variations within *A. tuberculata* and regard the differences in the shape of the front as being insufficient to warrant specific separation.

Distribution. Maldives and Andamans (Alcock), Ceylon (Laurie) and Borneo (Bell). Now recorded from Australia. The type locality is Borneo.

### *Arcania novem-spinosa* (Adams & White)

*Iphis novem-spinosa* Adams & White 1849, p. 56.  
*Arcania novem-spinosa*; Alcock 1896, p. 267 (description, syn. & refs.); Ihle 1918, p. 265; Buitendijk 1939, p. 229.

Diagnostic features. Front sharply bidentate. Carapace with nine spines; one spine on each hepatic margin, one on each lateral angle, one at middle of each postero-lateral margin, a pair on posterior margin and a single spine on intestinal region. Colour of spirit material: uniform pale pink, fingers white. Abdominal formula of female  $1 + 2 + 3 + R + T$ .

Material examined. One female (22.3 mm) between Cape Inscription and Cape St. Cricq, Shark Bay, W.A.-Haw. Exp. 16.v.1960, dredged at 38 fathoms, on loose coral and rock, WAM 283-60.

Comments. Our specimen agrees well with Alcock's description of *A. novemspinosa* except that the granule on each epibranchial angle is very small and scarcely discernible. On the merus of each cheliped, there is a sharp spine on the posterior proximal margin. This spine is not mentioned in any previous description. Dr. Gordon examined the holotype of *Iphis novemspinosa* and found that there is a spine in this position but it is blunt, not sharp. This spine can easily be overlooked as it is partly obscured by the carapace margin in certain positions of the cheliped.

Distribution. Philippines (Adams and White), Indian and Malay Archipelago (Alcock, de Man and Buitendijk) and north-east Australia (Haswell). Now recorded from Western Australia. The type locality is Philippines.

### Genus *Leucosia* Weber

The availability of *Leucosia* Weber is fully discussed by Holthuis (1959, p. 107).

Diagnostic features. Carapace sub-globular, polished with front projecting beyond the epistome. Thoracic sinus present. Postero-lateral margins ill-defined posteriorly; epimeral ridge thickened and continued around posterior margin. Abdominal formula of male  $1 + 2 + R + 6 + T$ ; or  $1 + R + T$ ; or  $1 + R + 6 + T$ ; first and second segments usually very small. Abdominal formula of female  $1 + 2 + R + T$  or  $1 + R + T$ . Second male pleopod one-quarter length of first pleopod. First pleopod three-quarters to nearly equal length of abdomen.

#### Key to Species\*

1. Some pubescence on hepatic or branchial regions ..... 2  
No pubescence on surface of carapace ..... 4
2. (1) Granules on dorsal surface of distal half of arm ..... *whitei*  
No granules on dorsal surface of distal half of arm ..... 3
3. (2) Pronounced hepatic angle ..... *angulata*  
No pronounced hepatic angle ..... *haematosticta*
4. (1) Granules on antero-lateral margin continued backwards to level of first or second pair of walking legs ..... 5  
Granules on postero-lateral margin continued backwards to level of last pair of walking legs ..... 9

\* This key does not include *Leucosia craniolaris* (Linnaeus) as there are no specimens in our collection. See p. 87.



- |   |                            |
|---|----------------------------|
| 5. (4) Granules on hepatic region of carapace   | 6                          |
| No granules on hepatic region of carapace   | 7                          |
| 6. (5) Front produced beyond eyes; anterior margin rounded  | <i>anatum</i> Morph D      |
| Front not produced beyond eyes; anterior margin straight  | <i>reticulata</i>          |
| 7. (5) Thoracic sinus deep up to level of last pair of legs   | <i>pubescens</i>           |
| Thoracic sinus deep only to level of first pair of legs   | 8                          |
| 8. (7) Front nearly straight or sinuous   | <i>haswelli</i>            |
| Front clearly tridentate  | <i>perlata</i>             |
| 9. (4) More than proximal half of arm covered by large tubercles; penultimate segment of abdomen of male smooth     | <i>ocellata</i>            |
| Only proximal one quarter of arm covered by granules, penultimate segment of male abdomen with well-developed spine | <i>L. magna</i> , sp. nov. |

### *Leucosia whitei* Bell

Plate I. 6 & 9, Plate II. 6 & 9.

*Leucosia whitei* Bell 1855a, p. 56; Alcock 1896, p. 225 (description, syn. & refs.); Ihle 1918, p. 283 (syn. & refs.); Stebbing 1920, p. 249; Barnard 1950, p. 386.

*Leucosia cheverti* Haswell 1879, p. 47, pl. 5, fig. 2 and 1882, p. 120.

**Diagnostic features.** Epibranchial angle sharp; granules on hepatic region and on dorsal surface of epibranchial angle. A narrow strip of pubescence on postero-lateral border of carapace. Granules cover entire dorsal surface of arm. Both inner and outer margins of hand sharply granulate. Colour of spirit material: brownish with white on anterior and posterior portions of carapace. Male with one deep red spot on dorsal surface of hand. Another on base of fingers, and two red spots on carapace. Female without red spots on hand and carapace. Abdominal formula of male 1 + 2 + R + 6 + T; second segment tiny. Abdominal formula of female 1 + 2 + R + T.

**Description of male pleopod** (Fig. 4, 10a & 10b, WAM 226-60). Short, stout, slightly curved with bulbous tip. Distal aperture at tip of a tooth in centre of bulb; bulb covered with long hair. One-half twist in shaft of pleopod. Shaft bare except for a small tuft on the inner side just above proximal aperture. Ridge straight on inner side of proximal half, then twisted into bulbous head across upper surface.

**Material examined.** One male (15.2 mm) 10 miles east of Eaglehawk I., Dampier Archipelago, W.A.-Haw. Exp. 14.vi.1960, dredged at 14 fathoms on mud and sand, WAM 226-60. One female (12.2 mm) ovigerous 7-8 miles north of Long I., off Onslow, W.A.-Haw. Exp. 17.vi.1960, dredged at 28 fathoms on sand and sponge, WAM 225-60.

**Comments.** *Leucosia cheverti* Haswell must, on present evidence, be regarded as a synonym of *L. whitei* Bell. The differences mentioned by Haswell (1880, p. 45) i.e., "obscure trilobation" of the front of *L. cheverti* as opposed to "3 minute teeth" on *L. whitei*, are not specific characters; in fact the front of the carapace is quite variable. Miers 1884, p. 249 mentions two specimens from Shark Bay with no trilobation at all. Our female is only slightly trilobed.

Haswell also mentioned the absence of granules on the hepatic region of *L. cheverti* as opposed to their presence on the hepatic region

of *L. whitei*. Miers (1884, p. 249) records four specimens from east Australia with varying numbers of granules on the hepatic region, another from east Australia with the granules obscure, and two from Shark Bay with no trace of granulation. Ihle, on the other hand, records five specimens from the East Indies with no granules on the epibranchial angle but definite ones on the hepatic region. In our female there is a slight indication of granules on the hepatic region but none on the epibranchial region. Unfortunately Haswell's type of *L. cheverti* could not be located in either the Australian or the Macleay Museum, so a direct comparison with our specimens could not be made.

The third point Haswell mentioned was the difference in colour pattern. Unfortunately no subsequent author has commented on this. Our female has the colour pattern described by Haswell for the male *L. cheverti*, whereas the colour pattern of our male is similar to that of Bell's female *L. whitei*.

These points are set out in Table II, p. 94; none of these characters seem to be associated with either size, sex or geographical distribution of the specimens.

**Distribution.** Indo Pacific from East Africa (Stebbing), Andamans (Alcock), East Indies (Ihle) to north-east and west Australia (Haswell, Miers). The type locality is "Australian Seas".

### *Leucosia angulata* (Rathbun)

Plate I.3, Plate II.3.

*Leucosides angulata* Rathbun 1911, p. 202, pl. xv, fig. 8.

**Diagnostic features.** Sharp epibranchial angle; lateral margin forming an obtuse re-entering angle with hepatic margin. Hepatic region with sparse pubescence. Ischium of each endognath of third maxilliped with a curved tooth at outer angle. Colour of spirit material: a spot of orange-brown on postero-lateral margin above first leg; tiny spots of the same colour unevenly distributed over the rest of the animal. Basic colour mottled brown-grey. Abdominal formula of female 1 + R + T.

**Material examined.** One female (15.6 mm) Maud Landing, W.A.-Haw. Exp., 20.v.1960, dredged at 10 fathoms on sand, weed and rock, WAM 227-60.

**Comments.** Only one specimen of this species, the male holotype, has been recorded previously. Our specimen which is a female, corresponds to the description of the type in all major features as shown in the diagnosis of the species. There are, however, a few minor differences between the type and our specimen, but these are not considered to be of specific importance. These differences are:

- (1) In our female there are two tubercles in the thoracic sinus instead of one in the type; this, however, is known to be a variable character in other species of *Leucosia*, e.g. *L. perlata*.
- (2) The distribution of the small red spots on the carapace of our female differs slightly from that described for the type; this too is known to be a variable character, e.g. *L. haematosticta*.



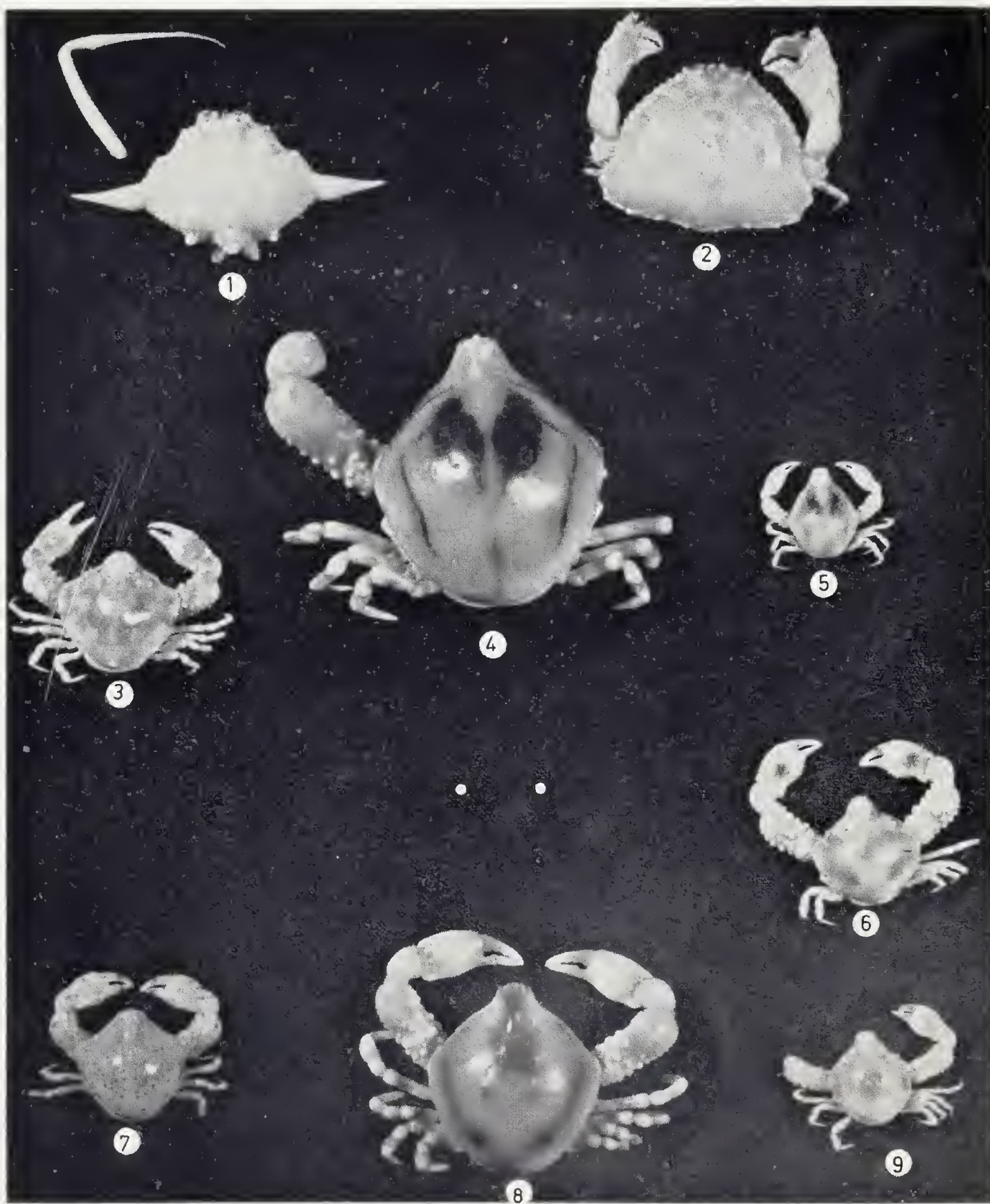
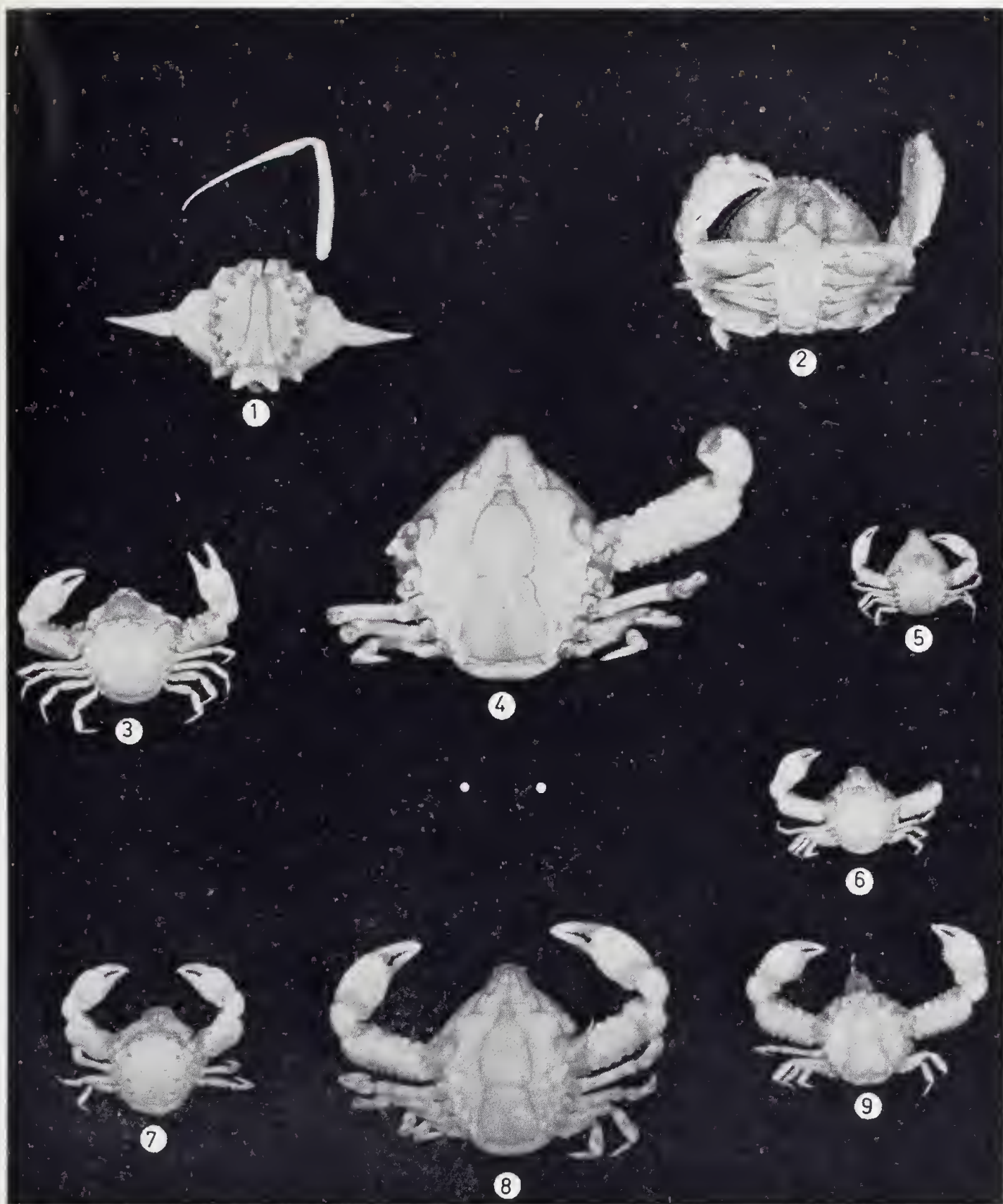


PLATE I.

Photographs of dorsal views of Oxystomata: 1. *Ixa acuta* holotype male; 2. *Calappa terrae-reginae* male; 3. *Leucosia angulata* female; 4. *Leucosia magna* holotype male; 5. *L. magna* paratype juvenile; 6. *L. whitei* male; 7. *L. haematosticta* female; 8. *L. haswelli* male; 9. *L. whitei* female. Distance between white dots 10 mm.



## PLATE II

Photographs of ventral views of Oxystomata:

1. *Ixa acuta* holotype male; 2. *Calappa terrae-reginae* male; 3. *Leucosia angulata* female; 4. *L. magna* holotype female; 5. *L. magna* paratype juvenile; 6. *L. whitei* female; 7. *L. haematosticta* female; 8. *L. haswelli* female; 9. *L. whitei* male.

Distance between white dots 10 mm.



- (3) Our female has a tooth (sharp prominence) in the middle of the intestinal region of the carapace, a feature not mentioned in Rathbun's description.
- (4) The front of our female is a rounded prominence with a shallow median depression, instead of the four-lobed front described for the type.

Distribution. Previously known only from the type locality, Seychelles. Now recorded from Australia.

***Leucosia haematosticta* Adams & White**

Plate I.7, Plate II.7.

*Leucosia haematosticta* Adams & White 1849, p. 54; Alcock 1896, p. 229 (description, syn. & refs.); Nobili 1903, p. 24; Stimpson 1907, p. 152; Yokoya 1933, p. 128; Sakai 1940, p. 40.

*Leucosides haematosticta*; McNeill & Ward 1930, p. 367, pl. 60, fig. 7-8; Buitendijk 1939, p. 230.

Diagnostic features. Epibranchial angle of carapace sharp; a very dense patch of pubescence on postero-lateral margin of carapace and also on proximal end of merus of cheliped. External margin of hand of cheliped carinate, internal margin with a line of granules. Colour of spirit material: anterior half of carapace pinkish grey; posterior half ivory white; whole of carapace, limbs and ventral surface covered with small regularly spaced red spots. Abdominal formula of male  $1 + R + 6 + T$  (Alcock). Abdominal formula of female  $1 + R + T$ .

Material examined. One female (14.5 mm), ovigerous, N.E. of Malus I., Dampier Archipelago, W.A.-Haw. Exp., 31.v.1960, dredged at 10 fathoms, WAM 224-60. One female (14.0 mm) damaged, 7 miles W. of Cape Couture, Bernier I., Shark Bay, W.A.-Haw. Exp., 16.v.1960, dredged at 30 fathoms, WAM 223-60.

Distribution. Palk Strait (Alcock), Singapore (Nobili), Japan (Miers and Stimpson), Timor (Buitendijk), Queensland and New South Wales (McNeill and Ward). Now recorded from Western Australia. The type locality is "Eastern Seas".

***Leucosia reticulata* Miers**

*Leucosia reticulata* Miers 1877, p. 237, pl. 38, figs. 13-15 (description); Haswell 1880, p. 45 and 1882, p. 118; Ihle 1918, p. 316.

Diagnostic features. Hepatic region of carapace with red granules; front straight. Colour of fresh specimens: grey to brown with darker reticulations or spots over carapace. Large granules on merus of cheliped often pinkish in colour. Abdominal formula of male  $1 + 2 + R + 6 + T$ ; second segment very small with only centre showing. Abdominal formula of female  $1 + 2 + R + T$ .

Description of male pleopod (Fig. 4.11, WAM 214-60). Stout, long and slightly sinuous. Distal half of shaft twisted five times. Penultimate and ultimate coils with a coiled transparent membrane, densely covered with long vibrissae. Ridge coiled. Proximal aperture fringed with vibrissae. Distal aperture at end of long thin spine-like projection; tip of projection spooned. Basal angle blunt, sparsely covered with fine pubescence.

Material examined. One male (28.8 mm) Monkey Mia, Shark Bay, B. R. Wilson, 2.i.1960, WAM 214-60. Five males (22.1-27.4 mm), six

females (22.9-27.7 mm), one of these (24.0 mm) ovigerous between October and December, two juveniles (11.3, 18.8 mm) from Yampi Sound, WAM 94-60, 212/13-60, 209/10-60, Broome WAM 114-61, Thevenard I., off Ouslow, WAM 211-60, Carnarvon, WAM 15-50, and Shark Bay, WAM 208-60, 1525/6-30 intertidally on reefs and beaches. (One male, WAM 94-60 donated to the British Museum and one specimen WAM 15-50 donated to the Leiden Museum).

Comments. An examination of the type by Dr. Gordon showed that the specimen is a parasitised female, and therefore the shape of the "male" abdomen given by Miers is incorrect. The male abdomen is here described and figured (Fig. 8.6, WAM 214-60). First segment extremely short and sunken. Second segment very tiny with only central region visible. Third, fourth and fifth segments fused, almost as long as sixth segment; surface of fused segments smooth, divided by a shallow depression into three rounded prominences. Sixth segment smooth except for a small tubercle in middle of proximal half of segment. Telson triangular, tip rounded; about one quarter length of fused segments. Distal portion of lateral margin of sixth segment fringed with very fine hairs.

Distribution. North and west Australia (Haswell and Miers). The type locality is Shark Bay.

***Leucosia anatum* (Herbst)**

(Plate III. 1 & 2, Fig. 5 & 6)

The holotype of *L. anatum* (Herbst) has recently been refigured by Holthuis (1959) and it is clearly a specimen of Morph C (see below).

*Cancer anatum* Herbst 1783, p. 93.

*Leucosia anatum*; Leach 1815, p. 334; Holthuis 1959, p. 107.

*Leucosia longifrons* de Haan 1841, p. 132, Tab. 33, fig. 6; Bell 1855a, p. 284 and 1855b, p. 6; Ortmann 1892, p. 585; Alcock 1896, p. 217; Laurie 1906, p. 2; Parisi 1914, p. 293; Bouvier 1915, p. 39; Ihle 1918, p. 316; Yokoya 1933, p. 127; Sakai 1937, p. 142, pl. 15, fig. 1; Stephensen 1945, p. 93; Utinomi 1960, p. 70, pl. 86, fig. 3.

*Leucosia polita* Hess 1865, p. 155, pl. 6, fig. 14; Haswell 1882, p. 120.

*Leucosia neocaledonica* Milne Edwards, A., 1874, p. 40, pl. 2, fig. 1; Haswell 1879, p. 46; de Man 1881, p. 123 and 1888, p. 197.

*Leucosia pulcherrima* Miers 1877, p. 236, pl. 38, figs. 4-6; de Man 1881, p. 123 and 1888, p. 198; Haswell, p. 119.

*Leucosia ornata* Miers 1877, p. 236, pl. 38, figs. 7-9; de Man 1888, p. 198.

*Leucosia splendida* Haswell 1879, p. 47, pl. 5, fig. 1 and 1882, p. 119.

*Leucosia australiensis* Miers 1880, p. 322, pl. 27, fig. 1; Stebbing 1893, p. 127, pl. 2; Hale 1927, p. 193, fig. 194; Yokoya 1933, p. 129; Sakai 1937, p. 145.

*Leucosia longifrons* var. *pulcherrima*; Alcock 1896, p. 218; Calman 1900, p. 27; Laurie 1906, p. 362; Ihle 1918, p. 316; Stephensen 1945, p. 94, fig. 17C (pleopod).

*Leucosides longifrons*; Rathbun 1910, p. 309.

*Leucosides longifrons pulcherrima*; Rathbun 1910, p. 309, pl. 1, fig. 14; McNeil & Ward 1930, p. 366.

**Unknown taxonomic position\***

*Cancer urania* Herbst 1801, p. 17, table 53, fig. 3.

*Leucosia urania*; Bell 1855a, p. 283 and 1855b, p. 6; de Man 1881, p. 123; and 1888, p. 197; Alcock 1896, p. 220; Laurie 1906, p. 363; Ihle 1918, p. 316.

*Leucosides urania*; Rathbun 1910, p. 309, pl. 1, fig. 1.

\* We believe that these names may be synonymous with the above. A full discussion follows.



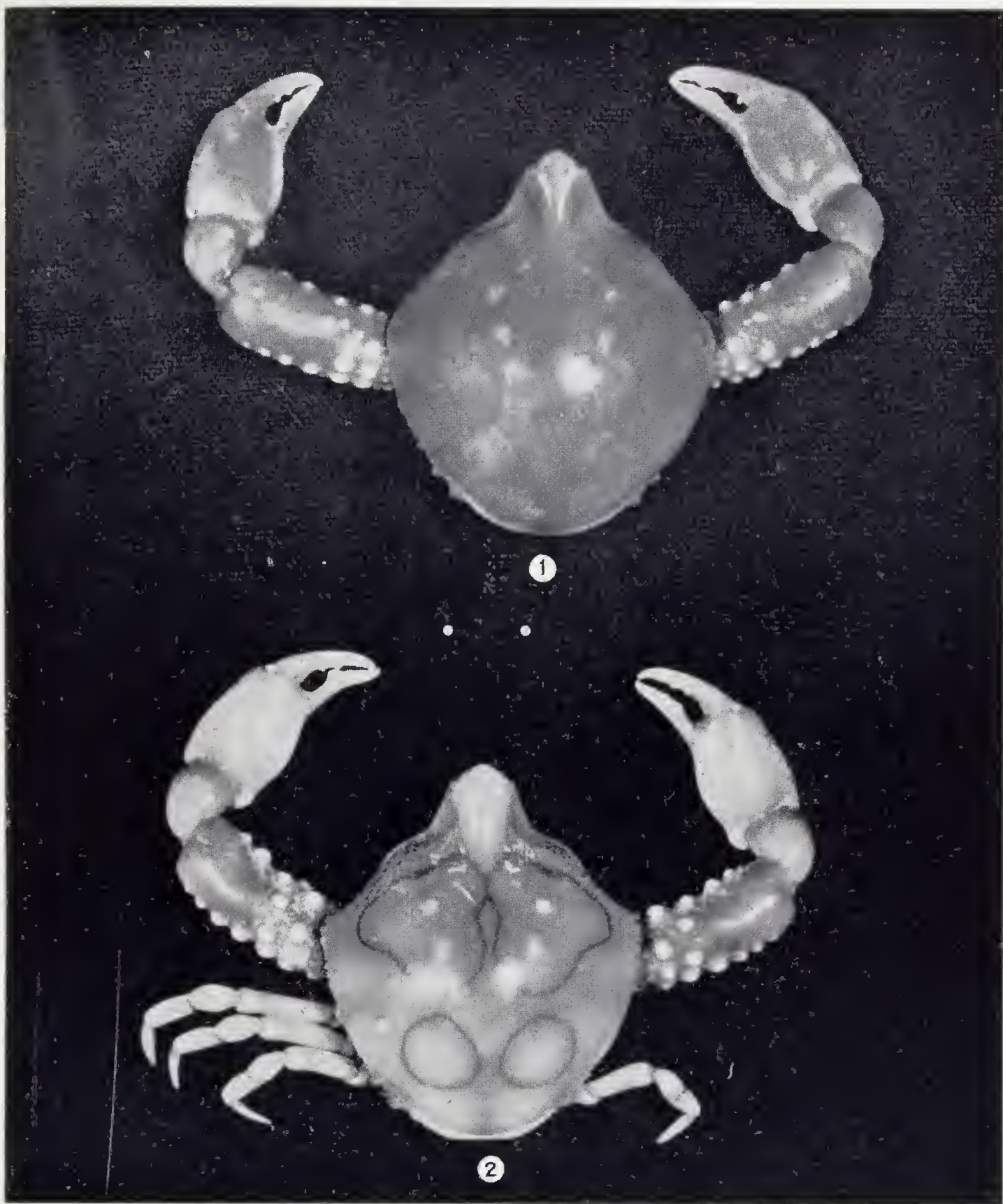


PLATE III.

Dorsal views of *Leucosia anatum*: 1. Male syntype *L. longifrons*-*L. anatum*, Morph A. 2. Male *L. anatum*, Morph D from Western Australia. Distance between white dots 5 mm.



Diagnostic features. Front rounded, dorsally convex and produced beyond eyes. Hepatic regions of carapace prominent; thoracic sinus with 5-7 well-defined pearly granules. Fingers crenulate only in their distal two-thirds. Abdominal formula of male 1 + 2 + R + 6 + T; second segment very small. Abdominal formula of female 1 + 2 + R + T.

Basic colour pattern stone-grey to brown on dorsal surface of carapace, white on sternum and abdomen. A horseshoe pattern of 6 white spots on gastric region; two white lines lead backwards from them towards branchial region. Large granules on arms, bands on legs and bases of fingers, orange. (Four morphological forms are recognised, see Comments.)

Description of male pleopod (Fig. 4.12, WAM 219-60). Straight and long. Shaft twisted upon itself three times; distal end of terminal coil bent and produced into a long thin tube. Distal aperture at tip of tube. Terminal coil with tuft of long vibrissae beneath tube. Penultimate and ante-penultimate coils with vibrissae. Basal angle blunt.

#### Material examined.

(a) Western Australian Museum material. One male (24.8 mm) N.E. of Malus I., Dampier Archipelago, dredged at 10 fathoms, W.A.-Haw. Exp., 31.v.1960, WAM 222-60. Four males (22.6-26.7 mm), six females (21.8-25.0 mm), two of these (22.9, 23.3 mm) ovigerous in May, from Flying Foam Passage, in 10 fathoms, WAM 216-60; west approaches to Mermaid Strait dredged at 20 fathoms, WAM 221-60; between Gidley and Rosemary Is., dredged at 14 fathoms, WAM 92-60; 30 miles N. of Dampier Archipelago dredged 31 fathoms, WAM 218-60; 5 miles off Steamboat I., dredged at 14 fathoms, WAM 215-60; near Long I., off Onslow, WAM 217-60 (donated to Leiden Museum), between Onslow and Port Simpson, dredged at 6-10 fathoms, WAM 219-60; and 2 miles S.W. of Peak I., N.W.A., dredged at 10 fathoms, WAM 220-60. One female, WAM 92-60 (donated to British Museum). Two males (18.9, 19.9 mm), three females (18.4-20.5 mm) and one juvenile (14.2 mm), Viti Levu I., Fiji, South Pacific, dredged between 6'-6', R. E. Pahl, 16.vii.1961, WAM 112-61, 113-61.

(b) Australian Museum material. One male (25.7 mm) Ceylon, P7697; 8 dry carapaces (16.5-27.0 mm), Sow & Pig's Shoal, Port Jackson, E. Australia, P 10075; 1 juvenile (15.9 mm) Persian Gulf, P 2671; 1 female (24.3 mm) Port Denison, Qld., P 3061. *Leucosia splendida* Haswell female holotype, Port Jackson, P 3907.

(c) Queensland Museum material. Two males (23.7, 24.6 mm) Bowen, mid E. Queensland; J. MacGregor, February 1934.

(d) Leiden Museum material. *Leucosia longifrons* de Haan, male syntype (25.8 mm) Japan, H. Bürger, Reg. no 803, R.M.N.H.

Comments. Colour patterns in this species fall into four main classes which we here designate as Morphs A, B, C and D. The species is clearly polytypic but we have insufficient evidence to describe the polytypic populations in various parts of its geographical range and we have not attempted to use subspecific names.

At present it seems that Morph C is widely distributed throughout the Indo-Pacific region and it coexists with Morphs A and B while A, B and D have not been found together (see distribution below). Names given by previous authors to these Morphs are included in the descriptions of each Morph.

Morph A. This morph exhibits the basic colour pattern described above, without any additional markings. *L. longifrons* de Haan.

Morph B. In addition to the basic colour pattern there is a pair of red circles on the branchial region of the carapace. *L. ornata* Miers and *L. longifrons*; Alcock.

Morph C. In addition to the pair of branchial circles, this form has red markings around the six white spots of the gastric region. Juveniles have a red circle around each white spot (*L. australiensis* Miers) and there may be an additional pair of red circles in the hepatic region; this is the condition of juveniles from Fiji (Fig. 8.7) and the Persian Gulf. Adults have a continuous red trefoil mark surrounding the white spots; these trefoil marks may be either separate or fused. *L. anatum* (Herbst), *L. pulcherrima* Miers, *L. neocaledonica* Milne-Edwards, *L. splendida* Haswell and *L. polita* Hess. A whole series of intermediate patterns from the simple red circles to the fused trefoil marks were found in the group of specimens from eastern Australia and also in the series from Fiji.

Morph D. The adult colour pattern is identical with that of Morph C but unlike all other Morphs, it has obvious red spots on the hepatic region, some of which are elevated to form distinct red granules (Plate III, 2). This form from Western Australia has not been described before.

It is not surprising that the list of synonyms is lengthy in view of the variability of the colour pattern within this species. The variability of colour pattern has been noted by de Man, Alcock and Bouvier. de Man (1881, p. 123) compared the types of *L. longifrons* de Haan and *L. neocaledonica* Milne-Edwards with *L. pulcherrima* Miers and considered these three species to be identical with *L. urania* Herbst. Later, in 1888 (p. 197) he included *L. ornata* Miers in this list of synonyms and Bouvier in 1915 agreed with de Man in making *L. longifrons* synonymous with *neocaledonica*.

After examination of the type of *L. neocaledonica*, Dr. Holthuis, (pers. com.) stated, "The colour pattern . . . is not very distinct, but on close examination part of the trefoil figure could be observed." This pattern was not noted by either Milne-Edwards or by de Man. It therefore agrees with our description of Morph C. A photograph of the type of *L. neocaledonica* is given in Fig. 5 by permission of Dr. Holthuis.

The male specimen from Ceylon (the type locality of *L. ornata*) shows just the two red branchial rings; the shape of the pleopod and the general morphology are identical with our material. This supports de Man's decision to include *L. ornata* in the synonymy. It is described here as Morph B.

A male syntype of *L. longifrons* (Plate III, 1) was lent to us by Dr. Holthuis for comparison with our material. No differences in the shape



of the pleopod or in the general morphology could be detected. This is described as Morph A.

Our suspicions that *L. australiensis* was based on juvenile specimens of Morph C were confirmed by Dr. Gordon who found that the two type specimens have not undergone the moult to puberty.



Fig. 5.—Male type of *Leucosia neocaledonica* (= *L. anatum*, Morph C). Natural size. (By permission of Dr. Holthuis.)

Alcock (1896, p. 217) regarded *neocaledonica* and *pulcherrima* as varieties of *L. longifrons* and retained *L. urania* as a separate species. However, Bouvier (1915, p. 39) states, "Au surplus, les types de *L. neocaledonica*, que j'ai sous les yeux, ne présentent point la plupart des caractères distinctifs que M. Alcock attribue à cette forme, et ces caractères n'ont pas été mentionnés par A. Milne-Edwards (1874, 40, Pl. II, fig. 1-1c); . . ." We received on loan from Dr. Ramakrishna a single specimen identified by Alcock as *L. longifrons* var. *neocaledonica* and found, like Bouvier, that the specimen is not *L. anatum*, Morph C (= *L. neocaledonica*) nor any other Morph of *L. anatum*. It is considered by us to be a new species of *Leucosia*, which we name *L. biannulata*. A full description is given in the Appendix to this paper.

**Distribution.** Morph A has been described as *L. longifrons* from Japan by de Haan, Parisi and Sakai; and from Siam by Rathbun.

Morph B has been recorded from Ceylon by Miers as *L. ornata*, and by Alcock from the Andamans, Mergui, Persian Gulf and Ceylon as *L. longifrons*.

Morph C has been recorded widely throughout the Indo Pacific from the Persian Gulf by Alcock as *L. longifrons* var. *pulcherrima*; from Ceylon by Laurie as *L. longifrons* var. *pulcherrima*; from Siam by Rathbun as *L. longifrons* var. *pulcherrima*; from Japan by Yokoya as *L. australiensis*; from Torres Strait by Calman as *L. longifrons* var. *pulcherrima*; from east Australia by Haswell as *L. splendida* and *L. pulcherrima*, by Hess as *L. polita*, by Miers as *L. pulcherrima* and by McNeill and Ward as *L. longifrons* var. *pulcherrima*; from south and south-east Australia by Miers as *L. australiensis*; and from New Caledonia by Milne-Edwards as *L. neocaledonica*. It is now recorded from Fiji.

Morph D is here recorded from Western Australia.

Herbst refers to Rumphius's (1705) specimens from Amboina, Moluccas and this is therefore the type locality.

**Discussion of *L. urania* Herbst.** We are not certain of the systematic position of *L. urania* Herbst and have therefore not included it as one of the morphs of *L. anatum*. Herbst's description mentions "some red blotches" on the posterior portion of the carapace. Bell (1855a, p. 283) and Alcock (1896, p. 220) described four red spots on the posterior of the carapace. Rathbun (1910, p. 309) reported that specimens which had been 6½ years in spirit, did not show any red coloration on the carapace.

Dr. Gruner of the Berlin Museum kindly compared one of our Western Australian specimens, WAM 218-60, with the female type of *L. urania* and found the following differences between the two:

- (1) The undersurface of the merus of the cheliped has smaller and more numerous tubercles than has our Western Australian *L. anatum*.
- (2) The crenulation on the distal two-thirds of the fingers of *L. urania* are more distinct.

Unfortunately Herbst's male type is missing; consequently the first male pleopods could not be compared. Also no trace of a colour pattern is visible on the female type of *L. urania*.

Dr. Gruner mentioned that the whole anterior edge of the thoracic sinus is granulate in *L. urania*, whereas in the specimen we sent him this was not the case. However this is variable,

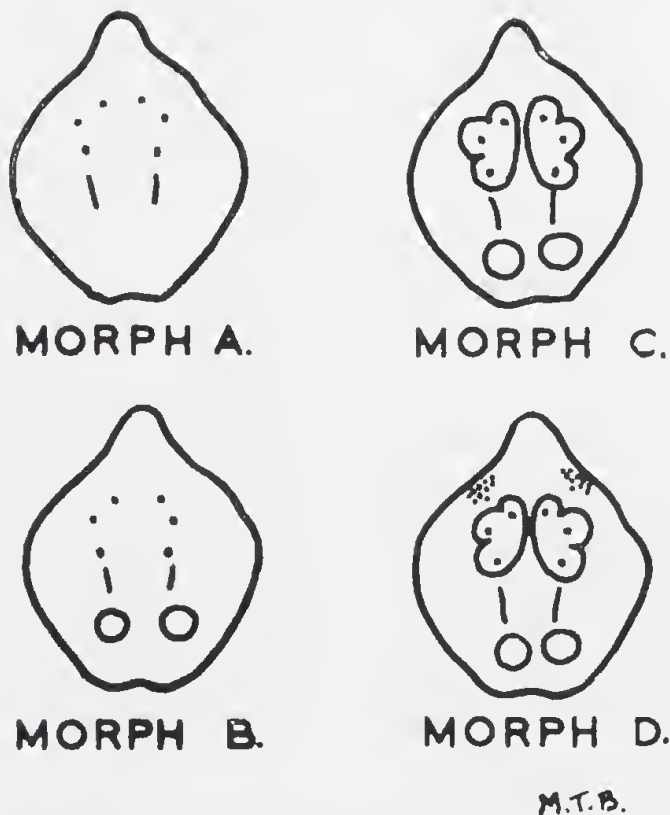


Fig 6.—Diagrammatic representation of morphs of *L. anatum*.



and the larger specimens in our collection are granulate all around the anterior margin of the thoracic sinus.

Specimens identified as *L. urania* by Herbst (1783) (figure approx. natural size according to Dr. Gruner, i.e., 46.0 mm), Alcock 1896 (38 mm) and Rathbun 1910 (30.3 mm) are larger than any specimens of *L. anatum* seen by us and consequently the morphological differences pointed out by Dr. Gruner may be due to their extreme size (i.e., if they are another morph of *L. anatum*). Bell (1855a) gave no measurements of his material, while Laurie (1906, p. 363) recorded a small specimen (17 mm) as *L. urania* and stated, "A series in the British Museum links this specimen with the adult form . . .". However, only one specimen of *L. urania* collected in 1897 could be located in the British Museum by Dr. Gordon in June, 1961, so verification of Laurie's conclusions was impossible.

De Man's (1881, p. 256) record of *L. urania* from Djeddah, Red Sea is incorrect. Dr. Holt-huis sent us one of these specimens, which he assigned to a different species *L. signata* Paulson, 1875, and we agree with this identification.

#### *Leucosia pubescens* Miers

*Leucosia pubescens* Miers 1877, p. 238, pl. 38, fig. 22-24 (description); Haswell 1879, p. 46 and 1882, p. 119; Alcock 1896, p. 233 (description); Laurie 1906, p. 363; Ihle 1918, p. 282; Glaucert 1924, p. 61; Stephensen 1945, p. 95, fig. 17 A-B (pleopod).

*Leucosides pubescens*; Buitendijk 1939, p. 230.

Diagnostic features. Front tridentate. Thoracic sinus deep, reaches level of last walking leg. Colour of fresh specimen: carapace light blue fairly uniformly covered with spots or marks of greenish brown; chelipeds and legs banded yellowish brown. Male abdominal formula  $1 + 2 + R + T$ ; second segment very small with only centre showing. Abdominal formula of female  $1 + 2 + R + T$ .

Description of male pleopod (Fig. 7. 1, WAM 513-39). Long, thin and slightly sinuous. Shaft twisted, making one gradual spiral. Distal aperture terminal, surrounded by a dark bristled membrane. Proximal aperture elongate. Entire surface covered with small thin hairs, denser proximally. Basal angle rounded.

Material examined. One male (23.3 mm) Claremont, Swan River, R. Moore, July 1939. WAM 513-39; seventeen males (22.2-25.2 mm), twenty-two females (15.5-25.6 mm), four ovigerous females (22.4-25.0 mm) in December, January and March from Exmouth Gulf WAM 234-60; Geraldton WAM 539-31; off Cottesloe WAM 235-60; Rottnest I. WAM 10810; Cockburn Sound WAM 3-37, 6/7-37, 341/2-39, 1-41, 19-51, 232-60; Swan River Estuary WAM 4039, 13322, 13431, 13688/91, 13818/9, 14314, 85/6-33, 265-33, 142-35, 498-39, 508/12-39, 8/9-51, 233-60, 3-61. (One male, one female, Swan River, A. E. Johnson, February 1951, WAM 8/9-51 donated to Leiden Museum.)

Distribution. Indian Ocean from Red Sea to India (Alcock and Laurie), East Indies (Ihle and Buitendijk) and west Australia (Miers, Haswell and Glaucert). The type locality is Shark Bay.

#### *Leucosia haswelli* Miers

(Plate I.8, Plate II.8.)

*Leucosia haswelli* Miers 1886, p. 324; Alcock 1896, p. 222 (description); Ihle 1918, p. 276 (syn. & refs.).

Diagnostic features. Front nearly straight or sinuous. Propodus of walking legs sharply carinate. Colour of fresh specimens: pale grey or brown, with an inverted Y of dark brown on the anterior region of the carapace, colour pattern often discontinuous. Dark brown spot on each branchial region, another to one side of cardiac region and a line of dark colour on each hepato-branchial region. Walking legs with white and light brown bands; fingers of chelipeds light brown proximally, white distally. Abdominal formula of male  $1 + 2 + R + 6 + T$ , second segment very small. Abdominal formula of female  $1 + 2 + R + T$ .

Description of male pleopod (Fig. 7.2, WAM 236-60). Stout and slightly sinuous. Distal half coiled five times, distal 3-4 coils covered with long vibrissae. Ridge on inner surface of shaft for about half length of pleopod before merging into first coil. End of pleopod projected to form a long, straight, spine-like structure. Distal aperture at tip of projection. Proximal aperture fringed with hairs. Basal angle elongate, spoonlike and sparsely covered with long hairs.

Material examined. One male (25.5 mm), N.E. of Malus I., Dampier Archipelago, W.A.-Haw. Exp. 31.v.1960, dredged at 10 fathoms, WAM 236-60. Fifteen males (18.6-27.6 mm), 13 females (23.7-28.5 mm), two juveniles (11.8, 17.4 mm) from 13 localities between Port Walcott and Cape Inscription, WAM 93-60, 237/250-60. (One male and one female from sample WAM 93-60 were donated to the British Museum and one male, Cape Inscription, W.A.-Haw. Exp. 15.v.60, WAM 242-60 donated to Leiden Museum.)

Distribution. Singapore, Bay of Bengal (Nobili), Andamans (Alcock), Gulf of Siam (Rathbun), Arafura Sea and Celebes (Miers); Thursday I. (Calman). Now recorded from Western Australia. The type localities are Arafura Sea and Celebes.

#### *Leucosia perlata* de Haan

*Leucosia perlata* de Haan 1841, p. 134; Ihle 1918, p. 281 (syn. & refs.); Miyake 1938, p. 199; Stephensen 1945, p. 95 (pleopod).

*Leucosia moresbiensis* Haswell 1879, p. 49.

*Leucosia pallida*; Alcock 1896, p. 222 (syn. & description).

*Leucosides perlata*; Buitendijk 1939, p. 230.

Diagnostic features. Front tridentate, hepatic margin very sinuous. Postero-lateral margin beaded almost to level of second pair of walking legs. A very strong backward directed spine on sixth segment of male abdomen. Colour of spirit material: dark grey on anterior two thirds of carapace, paler behind with a dark spot on either side of cardiac region. Fingers of chelipeds white. Male abdominal formula  $1 + 2 + R + 6 + T$ , second segment very small. Female abdominal formula  $1 + 2 + R + T$ .

Description of male pleopod (Fig. 7.3a & 3b, WAM 229-60). Long, slightly S-shaped and coiled seven times. Distal aperture on terminal spine surrounded by a dark hairy membrane. Proximal aperture wide, merging into folds of



Fig. 7.—First male pleopods of Oxystomata. Actual pleopod lengths given: 1. *Leucosia pubescens* (13.7 mm); 2. *L. haswelli* (14.1 mm); 3a. *L. perlata* (10.5 mm); 3b. *L. perlata* (lower view of tip with vibrissae removed); 4. *L. ocellata* (19.7 mm); 5. *L. magna* (Holotype) (19.4 mm); 6. *Pseudophilyra tridentata* (3.4 mm); 7. *Randallia eburnea* (7.3 mm); 8. *Myrodes eudactylus* (9.4 mm); 9. *Myra kessleri* (8.4 mm); 10a. *M. affinis* (8.3 mm); 10b. *M. affinis* (tip of lectotype); 11a. *M. australis* (tip at same magnification as 10b.); 11b. *M. australis* (9.3 mm); 12. *M. mammillaris* (21.3 mm).



the first coil. A few very tiny soft hairs along coils and longer more prominent vibrissae along edges of proximal aperture. Basal angle rounded, projected and spooned, with sparse hairs.

Material examined. One male (19.8mm), Jervoise Groyne, Cockburn Sound, E. Car, January 1959, WAM 229-60. Six males (17.8-19.9mm), six females (18.1 - 23.6mm), one of these (18.4mm) ovigerous, registered October 1922, from Yampi Sound, WAM 231-60; Broome, WAM 119-33, 116-61, 9383 and 8976; Port Hedland, WAM 228-60; Jervoise Groyne, WAM 230-60.

Distribution. "Persian Gulf east to New Guinea, Thursday I., and northward to Hong Kong. Also in Indian Archipelago" (Ihle). Now recorded from Western Australia. The type locality is "Moluccensis".

#### *Leucosia ocellata* Bell

*Leucosia ocellata* Bell 1855a, p. 289, pl. 31, fig. 1 (description) and 1855b, p. 8; Haswell 1880, p. 45 and 1882, p. 118; Miers 1886, p. 325 (additional description); Ihle 1918, p. 316.

Diagnostic features. Front tridentate. Sixth abdominal segment of male with rounded margins and without tubercles; almost as broad as long. Colour of spirit material: carapace pale brownish beige with two red spots on either side of mid-line in gastric region and one yellow spot on each branchial region. Carapace almost white near posterior margin. Male abdominal formula  $R + 6 + T$ .

Description of male pleopod (Fig. 7.4, WAM 251-60). Stout, bent sharply in middle. Two proximal coils twist to outside; the next two coils twist in the opposite direction. Distal end bulbous, formed by a vibrissae covered membrane; membrane continued into folds of distal two coils. Terminal bulbous membrane surrounds a very slender, recurved tooth. Proximal aperture fringed with hairs. Basal angle elongate, spoon-shaped without hairs.

Material examined. One male (21.6mm), N.E. of Malus I., Dampier Archipelago, W.A.-Haw. Exp., 31.v.1960, dredged at 10 fathoms, WAM 251-60.

Comments. Bell's description, based on a single female, does not include reference to the nature of the posterior margin of the merus of the last walking leg. In our female an obvious granulate crest is present in this position (Fig. 8.8a). Dr. Gordon kindly examined Bell's type of *L. ocellata* and in personal communication stated: "Here the granules run together to form a wavy crest. On the other walking legs the granules are disparate, flattened and just lie on the surface of the merus". Her camera lucida drawing is reproduced in Fig. 8.8b.

Distribution, Arafura Sea (Miers), east Australia (Haswell). Now recorded from Western Australia. The type locality is "Australian Seas".

#### *Leucosia magna*, sp. nov.

(Plate I.4 & 5, Plate II.4 & 5)

Description of holotype. Carapace sub-hexagonal, perfectly smooth and without pubescence. Anterior half of carapace punctate. Anterior

margin of carapace tridentate, median tooth longest. Antero-lateral border almost straight, evenly granular. True postero-lateral margin with granules decreasing in size posteriorly; granules extend to level of last walking leg.

Epimeral ridge thickened, granulate, continuous around posterior margin and ending anteriorly as a stout projection behind base of chelipeds. Thoracic sinus with 7-8 prominent granules and covered with pubescence except in region above granules. Anterior edge of sinus Y-shaped; lower arm of Y much longer than upper arm.

Ventral surface of third maxilliped smooth and flat. Abdominal formula of male  $1 + R + 6 + T$ . First segment very short and narrow. Fused segment as wide as long, with sinuous edges, narrowing anteriorly and posteriorly; surface smooth and divided by an obscure Y-shaped groove into one anterior and two posterior elevations. Sixth segment about two thirds as broad as long, with prominent forwardly directed spine placed centrally; sides convex, narrowing anteriorly. Telson tip rounded.

Left merus of cheliped slightly more than half length of carapace; left hand and entire right cheliped missing. Merus triangular in section with anterior surface granulate. Dorsal and ventral surfaces converging posteriorly to form a granular ridge. Dorsal surface of merus with cluster of small granules proximally and four larger granules distal to these. Some pubescence between these granules; rest of dorsal surface and all of ventral surface of merus smooth. Wrist circular in section and smooth except for some slight granulation on upper inner surface.

First walking legs missing. Merus of second and third legs rounded with one upper and one lower finely granulated ridge. Merus of fourth leg with ventral ridge only. Carpus of all walking legs round in section; propodus strongly carinate dorsally; dactyl lanceolate, triangular in section.

Colour pale grey, with a pair of dark brown blotches on gastric area, each blotch with two faint white spots. Posterior half of carapace with Y-shaped orange mark, arms of Y situated behind brown blotches. An orange line runs along each antero-lateral margin, a second orange line along posterior two thirds of each postero-lateral margin, and a third line inside these, bent at an angle similar to epibranchial angle of carapace.

Each walking leg banded bright orange around middle of merus, similar orange bands around joints of walking legs. Some granules on dorsal surface of merus of chelipeds margined with orange. Outside margin of exopodite of third maxilliped margined with orange. Sternum of thorax with some orange around telson of abdomen and anterior to insertion of each cheliped.

Description of Holotype male pleopod (Fig. 7.5, WAM 198-60). Thick, and slightly bent, shaft coiled three times. Terminal coil with a curved, distally expanded and flattened tooth; distal aperture at tip of this flat tooth. A hairy extension of penultimate coil projects as far as tip of tooth. A few vibrissae on lips of



proximal aperture; rest of pleopod, except for tip, bare. Basal angle sharp and spooned, densely covered with very fine pubescence.

Description of adult female paratype. As for holotype, except for following: Anterior margin of carapace worn almost straight. Abdominal formula  $1 + 2 + R + T$ ; fused section oval and very convex, with three transverse depressions indicating fusion lines. Left and right chelipeds missing. Both dorsal and ventral surfaces of first walking leg with granulate ridge. Orange marks on sternum extend backwards around abdomen to posterior margin of sternum.

Description of juvenile paratype (Plate I.5, Plate II.5). As for holotype, except for the following: Carapace more elongate. Fingers of cheliped shorter than hand; hand carinate on both inner and outer surfaces; inner carina of tiny granules. Orange lines on carapace of adult indicated by short orange marks. Base of fingers and distal margin of merus of cheliped orange.

Material examined. Holotype male 35.4 mm. W.A.-Haw. Exp., 2.vi.1960, dredged, WAM 198-60.

Type locality. 30 miles N. of Dampier Archipelago, north west Australia, 31 fathoms.

Paratypes. Adult female (36.0 mm) W.A.-Haw. Exp., 17.vi.1960, WAM 199-60. Locality: 7 miles N.W. of Anchor I., off Onslow, 46 fathoms on mud and gravel. One juvenile (11.7 mm) W.A.-Haw. Exp., 17.vi.1960, WAM 200-60. Locality: 7-8 miles N. of Long I., off Onslow on sand and sponge.

#### *Leucosia craniolaris* (Linnaeus)

One male and one female of this species were recorded by Rathbun (1924, p. 26) from Cape Jaubert, near Broome. We have not seen Western Australian specimens of this species.

#### Genus *Pseudophilyra* Miers

Diagnostic features. Carapace subglobular and shiny with projecting front but without thoracic sinus. Epimeral edge not thickened and not continuous around the posterior margin. Abdominal formula of male  $1 + 2 + R + T$ . Second pleopod one quarter length of first pleopod. First pleopod as long as abdomen. Only one species of *Pseudophilyra* is known from Western Australia.

#### *Pseudophilyra tridentata* Miers

*Pseudophilyra tridentata* Miers 1879, p. 41, pl. II, fig. 4 (description); Calman 1900, p. 28; Laurie 1906, p. 364; Ihle 1918, p. 314 *P. tridentata* misprint (refs.); Sakai 1937, p. 151, pl. xiv, fig. 7 and 1940, p. 37; Stephenson 1945, p. 77 (pleopod).

Diagnostic features. Front tridentate. Colour of spirit material: uniform pinkish-grey; chelipeds with band of orange on fingers.

Description of male pleopod (Fig. 7.6, WAM 253-60). Slender and tapered to a point. Distal third divided into two by deep cleft; both inner and outer divisions rigid. Ridge slightly oblique, meets outer division. Upper lip of proximal aperture with a few long vibrissae. Basal angle sharp.

Material examined. One male (8.2 mm) Maud Landing, W.A.-Haw. Exp., 20.v.1960, dredged at

10 fathoms on sand, weed and rock, WAM 253-60. Two males (9.5-10.0 mm) Maud Landing, data as above, WAM 252-60.

Distribution. Persian Gulf (Alcock), Gulf of Manar (Laurie), Siam, Ceylon, Red Sea, Torres Strait (Sakai) Japanese Seas (Miers and Sakai). Now recorded from Western Australia. The type locality is Lat.  $33^{\circ} 4' N.$ , Long.  $129^{\circ} 18' E.$  (S. Japan).

#### Genus *Randallia* Stimpson

Diagnostic features. Carapace subglobular, front bidentate; pterygostomial regions swollen. Surface of carapace covered with sharp granules visible only with a lens. Abdominal formula of male  $1 + 2 + R + 6 + T$ ; second pleopod one fifth length of first pleopod. First pleopod three quarters length of abdomen.

Only one species of *Randallia* is known from Western Australia.

#### *Randallia eburnea* Alcock

*Randallia eburnea* Alcock 1896, p. 197 (description); Illustrations of R.I.M.S.S. 'Investigator' 1897, pl. 30, fig. 4; Ihle 1918, p. 246; Sakai 1937, p. 132 and 1940, p. 37; Utinomi 1960, p. 72, pl. 36, fig. 8.

Diagnostic features. Tip of third maxilliped visible beyond front in dorsal view. Posterior margin of carapace armed with three petaloid processes. Colour of fresh specimen: yellowish-pink, with deeper pink on anterior margins of merus and hand of chelipeds; anterior portion of carapace and distal joint of merus of walking legs yellow. Fingers white.

Description of male pleopod (Fig. 7.7, WAM 207-60). Slender, gradually tapered and almost straight except for sharply bent tip. Shaft with some unevenly scattered hairs. Basal angle small and rounded with few hairs.

Material examined. One male (12.7 mm) 11 miles N.W. of Cape St. Cricq, Dorre I., Shark Bay, W.A.-Haw. Exp., 16.v.1960, dredged at 47 fathoms on sand, WAM 207-60.

Comments. Our male agrees with Alcock's and Ihle's description in most respects. The differences noted are given in Table III, p. 94.

Distribution. Laccadives (Alcock), East Indies (Ihle) and Japan (Sakai). Now recorded from Australia. The type locality is Laccadives.

#### Genus *Myrodes* Bell

Diagnostic features. Carapace subglobular with three posterior spines. Front truncate. Cheliped one and two thirds length of carapace. Fingers slender and hook-like; opposing edge of fingers armed with many fine teeth and fewer lancet-like teeth set at distant intervals.

Abdominal formula of male  $1 + 2 + R + T$ , of female  $1 + 2 + 3 + R + T$ . Second pleopod of male one fifth length of first pleopod. First pleopod nearly as long as the abdomen.

Only one species of *Myrodes* is recorded in the literature.

#### *Myrodes eudactylus* Bell

*Myrodes eudactylus* Bell 1855a, p. 299; Alcock 1896, p. 255 (description); Ihle 1918, p. 262 (syn. & refs.). *Myra eudactyla*; Haswell 1882, p. 123.



Diagnostic features. As for generic diagnosis. Colour of spirit material: carapace and chelipeds orange with blotches of lighter colour. Walking legs white with orange bands.

Description of male pleopod (Fig. 7.8, WAM 287-60). Long and almost straight. Ridge straight on inner, lower surface. Distal third with thin neck and flared tip surrounding distal aperture. Shaft covered with very fine pubescence, some longer vibrissae at base of neck. Basal angle prominent and sharp.

Material examined. One male (18.3 mm), Flying Foam Passage, Dampier Archipelago, W.A.-Haw. Exp., 30.v.1960, dredged at 10 fathoms on coral, shell and sand, WAM 287-60. Two males (20.5, 37.4 mm), one female (39.8 mm) from three localities between Port Sampson and Onslow, W.A.-Haw. Exp., June 1960, dredged at 23-28 fathoms, WAM 284/6-60.

Distribution. Andamans (Alcock), Siam Bay (Rathbun), Philippines (Bell), Arafura Sea (Miers), Darnley I., Torres Strait (Haswell), New Caledonia (Milne-Edwards). Now recorded from Western Australia. The type locality is Philippines.

#### Genus *Myra* Leach

Diagnostic features. Carapace similar to *Myrodes*. Fingers stout and slightly bent; opposing edges armed with fine teeth only. Abdominal formula of male 1 + 2 + R + T. Second pleopod one fifth to one third length of the first pleopod.

#### Key to Species\*

- |   |                       |
|---|-----------------------|
| 1. Facet on hepatic region bordered above and below by distinct lines of granules | 2                     |
| Hepatic area raised, not bordered as above  | 3                     |
| 2. (1) Median posterior spine longer and more pointed than lateral spines         | <i>M. affinis</i>     |
| Median posterior spine not longer and as round as lateral spines                  | <i>M. mammillaris</i> |
| 3. (1) All three posterior spines dorso-ventrally flattened                       | <i>M. kessleri</i>    |
| Median posterior spine and often lateral spines not dorso-ventrally flattened     | <i>M. australis</i>   |

#### *Myra affinis* Bell

*Myra affinis* Bell 1855a, p. 296; Alcock 1896, p. 205 (description); Laurie 1906, p. 361; Ihle 1918, p. 257 (syn. & refs.); Rathbun 1924, p. 26; Stephensen 1945, p. 71 (pleopod).

Diagnostic features. Carapace with evenly spaced tubercles; front with pair of short granular ridges; posterior spine long, recurved, sharply pointed; postero-lateral spine blunt; hepatic facet clearly marked by two lines of granules, one on upper and one on lower margin; hepatic angle sharp. Merus of third maxilliped with oblique line of raised granules. Walking legs not covered with granules. Fingers of cheliped shorter than hand. Colour of spirit material: carapace pale orange with faint orange markings; merus of cheliped banded orange; walking legs with faint orange bands.

\* This key does not include *Myra fugax* (Fabricius) which is not represented in the Western Australian Museum collection. See p. 89.

Description of male pleopod. (Fig. 7.10a, Siboga Exp. Stn. 311; 10b, lectotype drawn for us by Dr. Gordon). Long and straight. Ridge straight, ending in a short pointed tooth; tooth surrounded by tufts of vibrissae and with distal aperture at tip. Short pubescence along outer side of pleopod. Basal angle sharp.

#### Material examined.

(a) Western Australian Museum material. Ovigerous female (31.4 mm), 5 miles N. of Enderby I., Dampier Archipelago, W.A.-Haw. Exp., 28.v.1960, dredged at 22 fathoms on fine sand, WAM 277-60. Ovigerous female (25.5 mm) 7 miles N.N.W. of Anchor I., off Onslow, W.A.-Haw. Exp., 17.vi.1960, dredged at 46 fathoms on mud and gravel, WAM 280-60. Two juveniles (13.1, 17.2 mm), S.E. of Rosemary I., and off Anchorage Bay, Rosemary I., Dampier Archipelago, G. W. Kendrick and B. R. Wilson, 26-27.viii.1961, dredged in 3-5 fathoms on sand and shell, WAM 117-61, 118-61.

(b) Siboga Expedition material. One male (18.0 mm) and one female (20.8 mm), Station 311, east coast of Sumbawa, at 36 metres. Two males (15.0, 17.5 mm) and five juveniles (7.7-10.7 mm), Station 162, between Loslos and Gebroken Is., at 18 metres.

Comments. Dr. Gordon kindly examined the type series of *M. affinis* in the British Museum and noted that only one male from Cebu, Philippines, Reg. No. 43.6 (White's manuscript catalogue number is 731) has all its legs fairly intact and adhering to the body. Following her suggestion, we select this intact male as the lectotype of *M. affinis* Bell.

Distribution. Persian Gulf, Indian Archipelago (Alcock, Nobili, Laurie), East Indies (Ihle, Miers), north east and north west Australia (Haswell, Miers, Rathbun). The type locality is Cebu, Philippines.

#### *Myra australis* Haswell

*Myra australis* Haswell 1880, p. 50 and 404, pl. V, fig. 3 (description), and 1882, p. 122; Miers 1884, p. 184, 251 and 1886, p. 315; Walker 1887, p. 111; Henderson 1893, p. 402.

Diagnostic features. Carapace with close even cover of low tubercles, extended over front; posterior spine short and blunt; hepatic area raised, not margined by lines of granules; hepatic angles rounded. Whole of third maxilliped with close even cover of low tubercles. Walking legs covered with low tubercles. Fingers of cheliped shorter than hand. Colour of spirit material: carapace cream to brown with orange mottling; proximal half of merus of cheliped orange; walking legs banded orange.

Description of male pleopod (Fig. 7.11 a, WAM 270-60). General shape as for *Myra affinis* except that tip is relatively longer and narrower than tip of *M. affinis*. One specimen (WAM 272-60) is exceptional in that its pleopod tip consists of a curved tooth with a concavity on the outer side in which is situated a soft tooth-like structure (Fig. 7.11b). This is the condition in a Thailand specimen of *M. affinis* figured and described by Stephensen (1945, p. 71, fig. 74).



Material examined. One male (17.4 mm) 30 miles N. of Eagle Hawk I., Dampier Archipelago, W.A.-Haw. Exp., 2.vi.1960, dredged at 31 fathoms on sand, WAM 272-60. Three males (10.0-11.6 mm), Dampier Archipelago, W. of Eagle Hawk I., and N. of Steamboat I.; W.A.-Haw. Exp., May and June 1960, dredged at 14 fathoms on mud, WAM 270-60, 271-60. One male (15.0 mm), one female (17.4 mm) parasitised, one juvenile (10.1 mm), Dampier Archipelago, off Rosemary I. and Delambre I.; B. R. Wilson and G. W. Kendrick, 25-30.viii.1961, dredged 3-6 fathoms, WAM 123-61, 124-61, 125-61.

Comments. Alcock (1896, p. 206) suggested that *M. australis* is a juvenile form of *M. affinis*, and no subsequent workers disagreed with his statement. To check this suggestion of Alcock, we sent a male of *M. australis* (WAM 270-60) to Dr. Gordon, who kindly compared it with the lectotype of *Myra affinis*. These are her conclusions (pers. com.):

"... I can only say they are not identical. The differences are not such as would be due merely to the marked differences in size between the two. Your specimen though much more thickly and grossly granulate on back of body, has not the very distinct row of beading so very distinctly marking the lateral outline of the carapace. (The granules on back of both of Bell's specimens are sparser and much smaller than indicated in his figure.) *M. affinis* has a narrower and more upturned and longer front to carapace. In *affinis* also, the maximum depth of the chela is less than half the dorsal length of the palm; in your specimen the maximum depth exceeds half dorsal margin of palm."

Dr. Gordon provided us with camera lucida sketches to give an idea of the relatively longer, narrower abdomen in *M. affinis* and also the relatively shorter, broader propodus of pereopods 2 and 3 in *M. affinis*. These sketches are reproduced here with her permission (Fig. 8: 9a, 9b, 10a and 10b).

Additional distinguishing characters are included in the diagnosis of each species and on this evidence it is quite clear that *M. australis* is not a juvenile of *M. affinis* but is a separate species.

Distribution. Queensland, Torres Strait (Miers, Haswell), Singapore (Walker) and Gulf of Martaban (Henderson). Now recorded from Western Australia. The type localities are Sue, Darnley and Palm Is.; Cape Grenville, Qld.

#### *Myra kessleri* (Paulson)

*Callidactylus kessleri* Paulson 1875, p. 80.

*Myra kessleri*; Ihle 1918, p. 260 (syn. & refs.); Buitendijk 1939, p. 228.

*Myra darnleyensis* Haswell 1882, p. 122; Laurie 1906, p. 362.

Diagnostic features. Front distinctly bilobed. Side wall of carapace not margined by beaded lines. Three posterior spines flattened, petaloid. Fingers longer than hand. Colour of spirit material: pale yellow to pink, blotched with white. Transverse bands of pink on merus of cheliped. Abdominal formula of female 1 + 2 + 3 + R + T. First male pleopod almost as long as abdomen.

Description of male pleopod (Fig. 7.9, WAM 275-60). Almost straight, parallel-sided. Ridge straight, on inner side of pleopod. Tip blunt, covered with short hairs. Short fine pubescence covers pleopod, densest on basal angle. Basal angle rounded and elongate.

Material examined. One male (19.9 mm), 30 miles N. of Dampier Archipelago, W.A.-Haw. Exp., 2-vi.1960, dredged at 31 fathoms, WAM 275-60. Three females (16.6-18.9 mm), two of these ovigerous (16.6, 18.9 mm), 30 miles N. of Dampier Archipelago, W.A.-Haw. Exp. 2.vi.1960, dredged at 31 fathoms WAM 274-60, 276-60. One female (15.9 mm) ovigerous, 25 miles N.W. of Angel I., Dampier Archipelago, W.A.-Haw. Exp., 2.vi.1960, dredged at 37 fathoms, WAM 273-60.

Distribution. Red Sea (Paulson), Indian Archipelago (Alcock, Nobili), Seychelles (Rathbun), Laccadives (Borradaile), East Indies (Ihle, Miers), Darnley I., Torres Strait (Haswell), New Caledonia (Buitendijk). Now recorded from Western Australia. The type locality is Red Sea.

#### *Myra mammiliaris* Bell

*Myra mammillaris* Bell 1855a, p. 298, pl. 32, fig. 5; Miers 1884, p. 251; Ihle 1918, p. 313; Hale 1927, p. 197.

Diagnostic features. Cheliped twice length of carapace. Posterior spines rounded except median one which may be slightly pointed. Hepatic facet distinctly bounded by lines of granules. Colour of spirit material: uniform pale brown. Abdominal formula of female 1 + 2 + 3 + R + T. First male pleopod almost as long as abdomen.

Description of male pleopod (Fig. 7.12, WAM 281-60). Straight except for a slight bend in proximal half, slightly flattened dorso-ventrally. Ridge straight, on inner side of pleopod. Distal aperture opens at slight expansion on tip of tooth. Tooth surrounded by long bristles. Shaft of pleopod covered with fine hairs. Basal angle very sharp and pointed.

Material examined. One male (41.0 mm) 1 mile E. of Koks I., Bernier I., Shark Bay, W.A.-Haw. Exp., 17.v.1960, dredged, WAM 281-60. Five males (31.2-50.3 mm), five females (43.1-49.0 mm), one dry carapace (38.0 mm) from Yampi Sound, beach collection, WAM 279-60; Maud Landing at 10 fathoms on sand, weed and rock, WAM 278-60; Shark Bay, WAM 5785; Cottesloe, WAM 145/6-42; Leighton WAM 1036-31; Swan River Estuary, WAM 507-39; and from an unknown locality, WAM 11281 and parchment label 71.

Distribution. Port Denison, Queensland (Miers) South Australia (Bell, Hale). Now recorded from Western Australia. The type locality is South Australia.

#### *Myra fugax* (Fabricius)

One juvenile female of this species was recorded by Rathbun (1924, p. 26) from Cape Jaubert, near Broome. The species is not represented in the collection of the Western Australian Museum.

#### Tribe GYMNOPLEURA

This tribe consists of only one family, the Raninidae.



## Family RANINIDAE

Carapace longer than broad, greatest width in anterior third. Abdominal terga narrow, most of them visible in dorsal view. Buccal cavity elongate, completely closed by third maxillipeds. In our material, first male pleopod usually longer than abdomen, sometimes slightly shorter.

Four genera are known from Western Australia.

### Key to Genera

- |    |   |       |                   |
|----|---|-------|-------------------|
| 1. | V shaped incision instead of rostral point  | ..... | <i>Cosmonotus</i> |
|    | Rostral point present   | ..... | 2                 |
| 2. | (1) Compound teeth present on either side of rostrum                                      | ..... | <i>Ranina</i>     |
|    | Single teeth present on either side of rostrum  | ..... | 3                 |
| 3. | (2) Five sharp teeth present on anterior edge of carapace, i.e., rostrum and two pairs    | ..... | <i>Raninoides</i> |
|    | Seven sharp teeth present on anterior edge of carapace, i.e., the rostrum and three pairs | ..... | <i>Notopus</i>    |

### Genus *Cosmonotus* Adams & White

Diagnostic features. Carapace elongate, heptagonal in outline and strongly convex with a sharp mid-dorsal ridge. V shaped incision in front. Abdomen of both male and female of seven separate segments. Second male pleopod longer than first. First pleopod as long as abdomen.

Only one species of this genus is known from Western Australia.

### *Cosmonotus grayi* Adams & White

*Cosmonotus grayi* Adams & White 1848, p. 60; Alcock 1896, p. 292 (description); Ihle 1918, p. 294 (syn. & refs.); Stebbing 1920, p. 250; Yokoya 1933, p. 113; Sakai 1937, p. 173, pl. xvi, fig. 2 and 1940, p. 40; Stephensen 1945, p. 96 (pleopod); Barnard 1950, p. 400, fig. 75, h. 1.

Diagnostic features. Same as for genus. Colour of spirit material: whitish with a grey blotch in centre of carapace.

Description of male pleopod (Fig. 8.1, WAM 350-60). Basal segment large, tip pointed. Folds of shaft not completely overlapping, leaving an open groove to accommodate second male pleopod. Whole structure sparsely covered with hairs.

Material examined. One male (7.0 mm), western approach to Mermaid Strait, Dampier Archipelago, W.A.-Haw. Exp. 27.v.1960, dredged at 20 fathoms on coral and sand, WAM 350-60. One male (8.9 mm), one female (9.2 mm), 10 miles N. of Long I., off Onslow, W.A.-Haw. Exp. 17.vi.1960, dredged at 52 fathoms on mud, WAM 349-60.

Distribution. East Africa (Stebbing and Doflein), Persian Gulf (Alcock), East Indies (Henderson, Ihle, Adams & White) and Formosa (Stimpson). Now recorded from Australia. The type locality is East Indies.

### Genus *Ranina* Lamarek

Diagnostic features. Carapace elongate-pentagonal, widest across the front; covered by elongate scale-like granules. Adult with three compound teeth on either side of large rostrum. Abdomen of both male and female of seven separate segments. Second male pleopod two-thirds length of first. First pleopod longer than abdomen.

Only one species of this genus is known from Western Australia.

## *Ranina ranina* (Linnaeus)

*Cancer ranina* Linnaeus 1758, p. 625.

*Ranina ranina*; Yokoya 1933, p. 112; Sakai 1937, p. 178, pl. xvi, fig. 4 and 1940, p. 29; Barnard 1950, p. 397, fig. 75 a-d; Hughes, H., 1953 Photo.; Holthuis 1959, p. 107; Utinomi 1960, p. 73, pl. 37, fig. 1.

*Ranina scabra*; Ihle 1918, p. 295 (syn. & refs.); Boone 1934, p. 43, pl. 13 and 14 (description).

Diagnostic features. Same as for genus. Colour of spirit specimen: uniform pale grey. (Sakai's (1937) figure shows it to be red, spotted with white.)

Description of male pleopod (Fig. 8.2, WAM 419-31). Stout at base, tapering sharply towards tip. Tip flared. Lower surface of pleopod distinctly segmented (this was not noted in any other species). Basal aperture very wide, with the two flaps overlapping. Some very long vibrissae on outside middle third of pleopod and shorter hairs on inner side. Basal angle rounded and fringed with hairs.

Material examined. One male (125.7 mm), Abrolhos Is., J. Burton, received 30.v.1931, caught on a fishing line at 27 fathoms, WAM 419-31.

Distribution. Mauritius, Réunion, East Africa, East Indies to China, Japan and Sandwich I., (Barnard), and east Australia (Haswell). Now recorded from Western Australia. The type locality is Indian Seas.

### Genus *Notopus* de Haan

Diagnostic features. Carapace elongate sub-oval or sub-hexagonal. Widest part of carapace at level of antero-lateral teeth. Rostrum present. Abdomen of both male and female of seven separate segments; second male pleopod slightly longer than first pleopod.

### Key to Species

- |   |       |                    |
|---|-------|--------------------|
| A transverse spinulated ridge across carapace between antero-lateral spines | ..... | <i>N. dorsipes</i> |
| No transverse ridge across carapace   | ..... | <i>N. ovalis</i>   |

### *Notopus ovalis* Henderson

*Notopus ovalis* Henderson 1888, p. 31, pl. 11, fig. 6 (description); Ihle 1918, p. 317; Yokoya 1933, p. 112; Sakai 1937, p. 176 and 1940, p. 46.

Diagnostic features. No spinulated ridge between antero-lateral spines of carapace; antero-lateral borders straight, finely spinulate. Colour of spirit material: pinkish yellow with an orange elongate spot near each postero-lateral corner of carapace and a smaller spot of orange in centre of gastric region. First male pleopod slightly longer than abdomen.

Description of male pleopod (Fig. 8.3 a & b, WAM 348-60). Short curved with sides folded but not overlapping; edges with vibrissae. Open groove of shaft on inner side and directed slightly upwards. Basal segment flattened with inner margin smoothly rounded; outer edge relatively straight, with hairs.

Material examined. One male (26.2 mm), 7 miles W. of Cape Couture, Bernier I., W.A.-Haw. exp., 16.v.1960, dredged at 38 fathoms on sand, WAM 348-60. One male (23.2 mm), one female (21.8 mm), 8 miles W. of Wooded I., Easter Is., Abrolhos Is., W.A.-Haw. Exp., 12.v.1960, dredged at 82 fathoms, WAM 347-60.

Distribution. Japan and Little Ki I. (Henderson, Sakai). Now recorded from Australia.

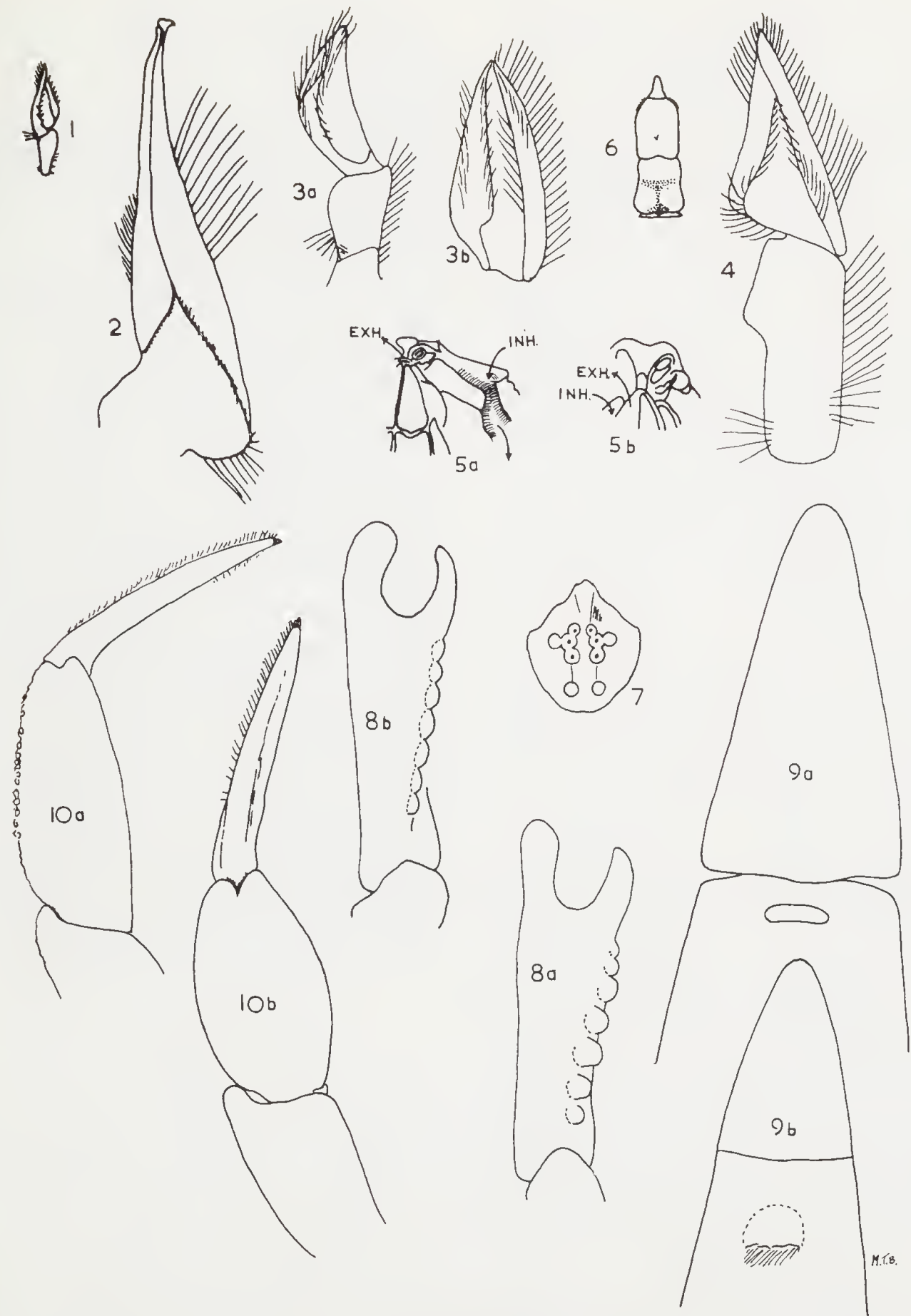


Fig 8.—1 - 4: First male pleopods of *Gymnopleura*. Actual pleopod lengths given. 5 - 10: Illustrations from text: 1. *Cosmonotus grayi* (2.6 mm, right pleopod); 2. *Ranina ranina* (26.0 mm, free hand drawing); 3. *Notopus ovalis* (5.4 mm); 3b. *N. ovalis* (inner view); 4. *N. dorsipes* (4.5 mm); 5a. Buccal cavity of *Matuta banksi* (after Barnard 1950); 5b. Buccal cavity of *Ebalia* (after Barnard 1950); 6. Male abdomen of *Leucosia reticulata*; 7. Juvenile of *L. anatum* from Fiji; 8a. Merus of pereopod V of *L. ocellata* (from W.A.); 8b. Merus of pereopod V of *L. ocellata* (type); 9a. Tip of abdomen of *Myra affinis* (lectotype); 9b. Tip of abdomen of *M. australis* (same magnification as 9a.); 10a. Pereopod II of *M. australis*; 10b. Pereopod II of *M. affinis* (lectotype).



### *Notopus dorsipes* (Linnaeus)

*Cancer dorsipes* Linnaeus 1758, p. 630.  
*Notopus dorsipes*; Alcock 1896, p. 290 (description); Laurie 1915, p. 429 (amendment of Alcock's description); Ihle 1918, p. 294 (syn. & refs.); Yokoya 1933, p. 112; Sakai 1937, p. 175, pl. xvi, fig. 1 and 1940, p. 40; Holthuis 1959, p. 108; Utinomi 1960, p. 73, pl. 37, fig. 2; Holthuis 1962, p. 55.

**Diagnostic features.** A ridge of small spines across carapace between antero-lateral spines. Antero-lateral border notched. Colour of spirit material: pinkish yellow with a pair of faint longitudinal lines near lateral borders. First male pleopod almost as long as abdomen.

**Description of male pleopod** (Fig. 8.4, WAM 344-60). Similar to *N. ovalis*, but shaft more pointed; open groove directed inwards and inner margin of basal segment more angular.

**Material examined.** One male (18.6 mm) 25 miles N.W. of Angel I., W.A.-Haw. Exp. 2.vi.1960, dredged at 37 fathoms on sand, WAM 344-60. Seven males (11.5-20.7 mm), four females (14.9-21.8 mm), one juvenile (9.3 mm) several localities in Dampier Archipelago, WAM 342-60, 343-60, 346-60; and between Point Sampson and Onslow, W.A.-Haw. Exp., June 1960, dredged at 23-31 fathoms, WAM 345-60.

**Distribution.** Red Sea (Laurie), India (Alcock), East Indies (Ihle) and Japan (Sakai). Now recorded from Australia. The type locality is Amboina.

### Genus *Raninoides* Milne-Edwards

**Diagnostic features.** Carapace elongate oval, widest part of carapace somewhat behind level of antero-external spines. Abdomen of both male and female of seven separate segments.

Only one species of this genus is known from Western Australia.

### *Raninoides personatus* Henderson

*Raninoides personatus* Henderson 1888, p. 27, pl. II, fig. 5 (description); Alcock 1896, p. 293; Ihle 1918, p. 317; Yokoya 1933, p. 113; Sakai 1937, p. 167 and 1940, p. 46.

**Diagnostic features.** A sharply granulate, slightly curved, shallow ridge across carapace between antero-external spines. Colour of spirit material: anterior half of carapace greyish; posterior half pinkish, posterior two thirds of carapace covered with some orange spots.

**Material examined.** One female (29.8 mm) ovigerous, 3 miles N.N.E. of Anchor I., off Onslow, W.A.-Haw. Exp., 17.vi.1960, dredged at 22 fathoms on mud, WAM 351-60.

**Distribution.** Bay of Bengal (Alcock), Amboina (Henderson), Japan (Sakai and Yokoya). Now recorded from Australia. The type locality is Amboina.

## APPENDIX

In the course of our investigations on *Leucosia anatum* we found that the specimens named by Alcock, *Leucosia longifrons* var. *neocaledonica* are misidentified and belong to a new species. Alcock gave a very good description of it (1896, p. 218) and because of its marked characteristics, regarded it as a well marked variety or perhaps a distinct species.

One male specimen was sent on loan by Dr. Ramakrishna, Indian Marine Survey, Calcutta (Reg. No. 147-63/10) and this specimen is the holotype of this new species.



Fig. 9.—*Leucosia biannulata* holotype male; upper, dorsal; lower, ventral view. Distance between white dots 10 mm.

### *Leucosia biannulata*, sp. nov.

Fig. 9

*Leucosia longifrons* var. *neocaledonica*; Alcock 1896, p. 218 (misidentified).

**Description of holotype.** Carapace pentagonal, hepatic region prominent. Front curved downward, unidentate, produced well beyond level of eyes. Surface of carapace closely punctate. Antero-lateral borders granulate, granules continuous along postero-lateral borders to level of first walking leg. Epimeral edge also granulate, granules continuous around posterior margin. Thoracic sinus Y-shaped, with 5 small pearly granules. Anterior margin of merus of chelipeds with about 14 unequal sized granules; posterior margin with about 9 granules. Proximal end of upper surface of merus with a cluster of small granules, distal three quarters smooth. Anterior surface of merus granulate, ventral surface smooth except for proximal region.

Wrist with 2-3 small granules along anterior edge, hand carinate on outer edge, 2-3 rows of small granules along inner edge. Fingers crenulate in distal two thirds only.

Dorsal edge of merus of walking legs with a fine granulate ridge, ventral edge with a double row of fine granules; propodus with well marked carina; dactyls lanceolate.

Colour of holotype many years in spirit: uniform fawn, with two pale spots clearly visible on gastric region, each surrounded by a wide orange ring. From each ring a white line leads backwards. (Alcock's description of the colour of a fresh specimen is as follows: "On the gastric region is a pair of large ocelli with small white centres and very broad red outer rings. In faded specimens the colours are much those of *L. longifrons*, but even then, instead of two round spots or rings in the posterior half of the carapace, there are from 4-6 large spots round the posterior half of the circumference of the carapace". These spots are not discernible in the holotype.)

Abdominal formula of holotype 1 + 2 + R + 6 + T, R with a deep median groove along proximal two thirds. Sixth segment with almost parallel sides and a broad median ridge distal to a tiny sharp tubercle. Telson triangular with a rounded tip.

Description of male pleopod (Fig. 4, 13a & 13b). Pleopod straight with shaft twisted 3 times. Terminal coil slightly bulbous at base, projected into flattened tooth. Terminal tooth directed obliquely down and outwards in situ. Pleopod bare except for some long vibrissae on bulb of terminal coil. Basal angle blunt.

Holotype male (21.4 mm) Indian Marine Survey Reg. No. 147-63/10.

The type locality is Palk Strait, India.

Comments. *L. biannulata* resembles *L. anatum* (Herbst) except that:

- (1) The tip of the first male pleopod is flattened and directed laterally and externally in situ, whereas that of *L. anatum* is needle-like and directed dorsally in situ.
- (2) The anterior half of the carapace is decorated with a pair of large red ocelli with small white centres, whereas none of the morphs of *L. anatum* has thick-rimmed red ocelli on the carapace.
- (3) The merus of the walking legs have 1 dorsal and 2 ventral longitudinal lines of granules; those of *L. anatum* are smooth.
- (4) The propodus of the walking legs have well defined carina; those of *L. anatum* are not so highly carinated and are more rounded in cross-section.

(5) The sixth segment of the male abdomen is parallel sided for most of its length, whereas in *L. anatum* the sides gradually converge towards the tip.

(6) The front of *L. biannulata* is much narrower than that of *L. anatum*.

Distribution. Palk Strait, Karachi and Persian Gulf (Alcock).

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**TABLE I**  
Differences between *Ixa acuta*, *I. edwardsi* and *I. monodi*

	<i>I. acuta</i>	<i>I. edwardsi</i>	<i>I. monodi</i>
Exopodite of 3rd maxilliped covered with :	Some small sharp tubercles	Large polished pearly granules	Some low, small flattened tubercles
Constriction at base of lateral spine	Present	Present	Absent
No. of prominences on posterior portion of carapace	Five. Two submedian tubercles, 1 intestinal protuberance and 2 protuberances, one on either side of the intestinal region	Three. Two submedian tubercles and 1 intestinal protuberance	Two. Two distinct submedian granular tubercles. Intestinal region slightly elevated only
Spinule on tip of pleopod	Absent	?	Present

**TABLE III**  
Morphological variations in males of *Randallia eburnea*

	After Alcock	After Hile	Our male
	Dactyls with few hairs on tip only	Same as Alcock	Distal one third of first to third dactyls with long hairs
	3rd-5th abdominal segments fused, though all clearly recognisable, formula 1 + 2 + R + 6 + T	3rd-6th abdominal segments fused, all clearly recognisable, formula 1 + 2 + R + T	2nd-6th abdominal segments fused, only faintly recognisable by slight bulging at sides, formula 1 + R + T
	No mention of tooth on penultimate segment of abdomen	Same as Alcock	Distinct flattened tooth on penultimate segment of abdomen

**TABLE II**  
Morphological variations in *Leucosia whitei*

Author	Reference	Name	Sex	Car. lgth.	Locality	Front	Hepatic Region	Branchial Region	Distribution of Red Colour
Bell	1855 p. 289	<i>L. whitei</i>	♀	0.6 in. 15.2 mm.	East coast of Australia	3 minute teeth	Slightly raised with 3 or 4 minute granules	With 3 or 4 minute granules near margin	Large red spot on upper surface of hand, some on carapace
Haswell	1880 p. 45	<i>L. whitei</i>	♂	?	Princess Charlotte Bay, Cape Grenville, Brook L.	Minutely tridentate	3 or 4 granules	3 or 4 granules	?
Haswell	1880 p. 47	<i>L. cheverti</i>	♂	4½ lines 9.5 mm.	Cape Grenville, Darnley L.	Obscurely trilobed	Rounded elevation with no granules	?	Fingers red at base
Miers	1884 p. 249	<i>L. whitei</i> syn. <i>L. cheverti</i>	?	?	Flinders Clairmont N. E. Australia, Prince of Wales Channel	? Presumably trilobed	No. of granules vary in 4 specimens : obscure in 1 specimen	?	?
		"variety cheverti"	?	?	Shark Bay, W.A.	No trace of trilobation	No granules	?	?
Miers	1886 p. 325	<i>L. whitei</i>	♂	12.5 mm.	Arafura Sea, Sth of New Guinea	?	?	?	?
Alcock	1896 p. 225	<i>L. whitei</i> syn. <i>L. cheverti</i>	♀	14 mm.	Andamans	3 broad denticles	granular eminence	granules	Bleached
Hile	1918 p. 283	<i>L. whitei</i> syn. <i>L. cheverti</i>	♀ ♀ 1 juv. 1 juv. 1 juv. ♀	13 mm.	Bay of Bina Makassar Between Loslos and Gebroken I. South coast of Timor Haingsisi South of Salawatti I.	?	All possess granules	No granules	?
								Granules present	
Siebbing Barnard	1920 p. 249 } 1950 p. 386 }	<i>L. whitei</i>	♀	10 mm.	Natal coast	?	?	?	?
Our specimens			♂	15.2 mm.	Dampier Archipelago NWA	Tridentate	Prominence with 6-7 granules	6-7 granules	Red on upper surface of hand, bases of fingers and on carapace
			♀	12.2 mm.	Off Onslow NWA	Faintly tridentate	Prominence with few very faint granules	No granules	On bases of fingers

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